Cover Photo: Niagara Escarpment, Peninsula State Park
Photographed by Gary Fewless, University of Wisconsin-Green Bay

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Eric Epstein – botany, ecology, rare flora
Gary Fewless – botany, ecology, rare flora
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THE NIAGARA ESCARPMENT

INVENTORY FINDINGS 1999-2001 AND CONSIDERATIONS FOR MANAGEMENT

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INTRODUCTION

The Niagara Escarpment has emerged as a statewide critical natural resource area in recent years due to its unique geology, the presence of rare plants and animals, and growing development pressure. It is a priority study area for the Bureau of Endangered Resources and the Department of Natural Resources, as well as other regional and state agencies and private conservation organizations in Wisconsin.

This report presents the results of a study conducted during 1999-2001 to collect and compile information about the biodiversity of the Niagara Escarpment throughout its course in Wisconsin, and to identify elements of biodiversity that are most closely associated with the Escarpment. The study was undertaken by the Natural Heritage Inventory (NHI) Program of the Wisconsin Department of Natural Resources' Bureau of Endangered Resources. Work emphasized consolidation of existing data and information plus field inventory to fill in gaps and to gather more complete information on key sites.

The information provided in this report is intended to support current and future planning efforts for the Department, local planning agencies, concerned community groups, and other organizations. This compilation should provide a tool with which to evaluate the ecological significance of the Escarpment and provide background for conservation efforts and management considerations. By focusing on the Escarpment as a whole, we hope that this report provides a useful frame of reference for regional and local studies dealing with portions of this important area. We also hope that the emphasis on rare species and natural communities in this report will complement other, more general information about the area. Terms that may be unfamiliar to readers are defined in Appendix 1.

DESCRIPTION OF STUDY AREA

This report covers the seven counties that contain the majority of the Niagara Escarpment in Wisconsin. The study area includes the exposed bedrock of the Escarpment within these counties plus a 5 mile buffer on all sides (Map 1). The seven counties are Brown, Calumet, Dodge, Door, Fond du Lac, Kewaunee, and Manitowoc. Nearby outliers of exposed bedrock were excluded from the study area because of their small size and, in most cases, their non-dolomitic composition, which indicates that they are not part of the Escarpment.

ECOLOGICAL SETTING OF STUDY AREA

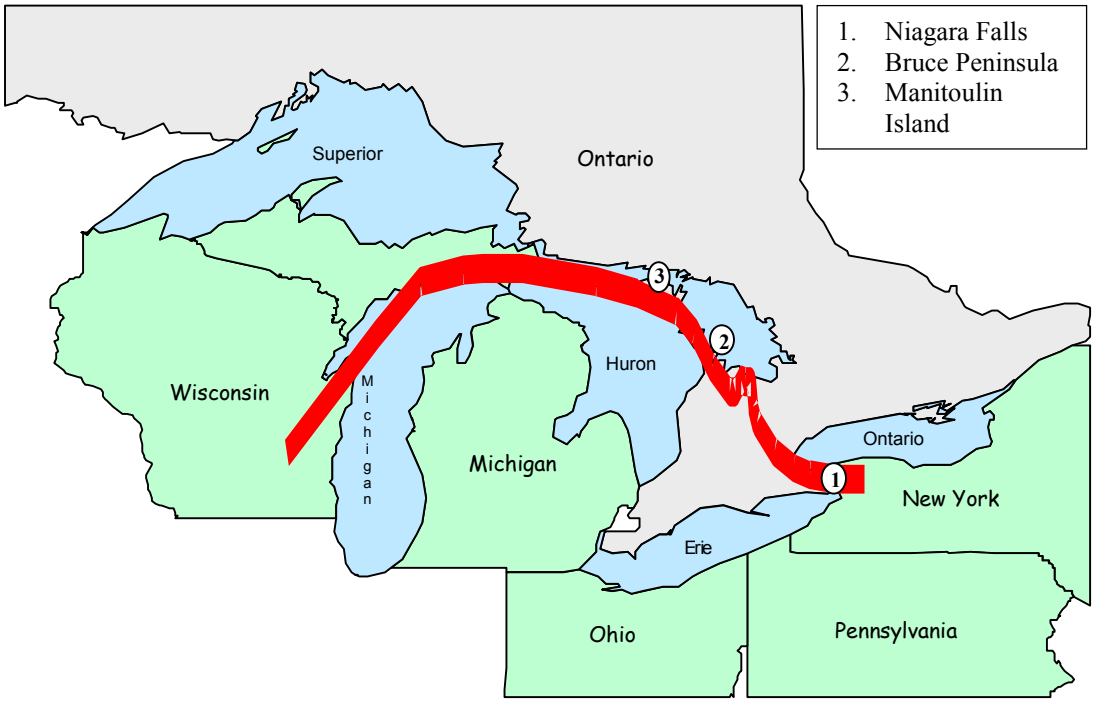
The study area falls within 3 of Wisconsin's 16 ecological landscapes, based on a system of land classification developed by the Wisconsin Department of Natural Resources. This system divides the state into ecological units based on combinations of biotic and environmental factors, which include climate, physiography, soils, hydrology, and vegetation (Map 2). The Department's system is a modification of the National Hierarchical Framework of Ecological Units (NHFEU). The 3 ecological landscapes pertinent to this study are:

1. **Northern Lake Michigan Coastal:** Lake Michigan climate influence; gently rolling to flat topography with clay and loam soils; land cover now dominated by agriculture in the south and mixed conifer-hardwood forest in the north.
2. **Central Lake Michigan Coastal:** Lake Michigan climate influence; generally flat topography with clay and silt loam soils; land cover now primarily urban and agricultural; some remnant northern hardwood forest with maple, beech, and some hemlock, plus conifer swamps, hardwood swamps, and riverine marshes.
3. **Southeast Glacial Plains:** Gently rolling to flat topography with clay or silt loam-textured soils on till plain; land cover now primarily urban and agricultural; small remnant oak openings, oak forest, tallgrass prairie, and sugar maple-basswood forest.

GEOLOGY OF THE ESCARPMENT

The Niagara Escarpment is the steep face of a 650-mile sickle-shaped cuesta (bedrock ridge) that runs from the northeastern United States south of Rochester, New York, across portions of southeastern Canada, and then southward north and west of Lake Michigan to southeastern Wisconsin (Map 3). The portion of the Escarpment occurring in Ontario Canada has been designated as a World Biosphere Reserve by the United Nations Education, Scientific and Cultural Organization (UNESCO).

Map 3. Escarpment Location in Relation to the United States and Canada.



Large area of recently exposed dolomite on point at south end of Sand Cove, September 30, 2000. Photo by Gary Fewless

The primary bedrock type is dolomite, formed from accumulated sediments of an ancient sea 405-425 million years ago during the Silurian Period of the Paleozoic Era (Paull and Paull, 1977). The Escarpment was formed over millions of years through the differential erosion of rocks of different hardness. A cap of erosion-resistant dolomite overlies weaker, more easily eroded and weathered shale rocks. Through time the soft rocks weather and erode away by the action of water, and freezing and thawing cycles. The gradual removal of the soft rocks undercuts the resistant caprock, leaving series of cliffs – the Niagara Escarpment. The Silurian dolomite is a calcareous rock unit with high concentrations of magnesium and small concentrations of iron (Corbisier et al., 2000).

In Wisconsin, the Escarpment extends for over 230 miles (Martin, 1965), from Rock Island, off the northern tip of the Door Peninsula, south to northern Waukesha and Milwaukee counties (Watermolen et al, 1997). The Escarpment is discontinuous in Wisconsin and differs in elevation and amount of exposure from one end to the other. The middle portion of the Escarpment is over 300 feet higher than the northern and southern ends (Bay-Lake Regional Planning Commission, 2001). A good example of the variability of the Escarpment is on the Door Peninsula where the Escarpment is expressed as a prominent rock face and steep west-facing scarp with cliffs reaching 150 feet in height (Map 4). The bedrock of the cuesta has a gentle eastward dip that outcrops at many locations along the Lake Michigan shore of the northern Door Peninsula as series of ledges, low cliffs, and pavements.

The role of glacial processes in shaping the Escarpment in Wisconsin is described by the Bay-Lake Regional Planning Commission (BLRPC):

> Glacial processes also have impacted the escarpment greatly, controlling its expression in a variety of ways related to the direction of ice movement. For example, the glaciers may have eroded the western edge of the escarpment back five to ten miles on the north, smoothing out the irregular cliff face and removing outliers, as the ice moved parallel to it. Farther south, where the ice moved obliquely, the outline of the escarpment is more irregular. Much of the southern portion of the escarpment is partly buried by glacial deposits (BLRPC, 2001).

Areas along the Niagara Escarpment have thin soil deposits due to glacial scouring and relatively little post glacial deposition. These conditions of shallow soils lying directly over fractured bedrock make the area susceptible to groundwater contamination.

The geology of the Escarpment greatly influences its ecological attributes. One example is the presence of the karst or solution features of the bedrock that allow organic matter to accumulate. Cold air and sometimes water move through the fractured rock creating unique microhabitats, some of which mimic cold air slopes (Corbisier et al, 2000). Many highly specialized species, such as rare terrestrial snails, are found in these microhabitats and some of them may occur in few or no other locations in the world (WDNR, 2002).

LAND COVER AND LAND USE

The first systematic record of vegetation in Wisconsin occurred in the mid-1800s, when the U.S. General Land Office completed a land survey of the entire state to facilitate European settlement (Les, 1995). Vegetation maps based on these records show a diverse mosaic of natural communities, including extensive forests and wetlands, as well as fire-dependent grassland, barrens, and savanna communities. On the Door Peninsula forest dominants included sugar maple, basswood, yellow birch, beech, elm, white pine, and hemlock. From lower Green Bay south, the native vegetation was composed primarily of deciduous forest (oaks, maples, ashes, basswood), oak savanna, prairies, and wetlands.

During the last half of the nineteenth century much of the pre-settlement forest was cut and much of the land was cleared for agriculture, especially fruit orchards. Farming along the Escarpment was difficult due to the shallow soils and steep slopes, and settlement patterns were affected by the bedrock-controlled topography. The dolomite bedrock was available for foundation material or to be burned to produce lime. Today, a number of county operated or privately owned quarries supply crushed stone primarily for road base or concrete aggregate and riprap.

Current land use patterns along the Niagara Escarpment were documented in a comprehensive assessment by the Bay-Lake Regional Planning Commission (2001). The report characterized land use and cover along the Escarpment as a mix of agricultural land, woodlands, and locally concentrated developments. Land use patterns on Door Peninsula were described as follows:

> Going from north to south the woodlands decrease in size and abundance with a natural break just north of Sturgeon Bay. South of Sturgeon Bay, land use is typically agricultural with scattered wood lots and development. Large concentrations of development are in and around Sturgeon Bay, Green Bay, east and northeast of Fond du Lac, and smaller areas of development are located in the villages of Ephraim, Sister Bay, and Egg Harbor…. The majority of the shoreline in Brown and Kewaunee counties is also developed, mostly with residential uses (BLRPC, 2001).

Shoreline near the Escarpment has been extensively developed near the cities of Green Bay, Fond du Lac, and Sturgeon Bay, as well as at many areas in between these cities.

> The development along the shoreline from Green Bay to Sturgeon Bay can be viewed as a timeline of development trends. Development that took place in Green Bay and the town of Scott is now starting to become apparent in Red River and Union. The same pattern is occurring north from Fond du Lac along the escarpment into the towns of Empire and Taycheedah. Second tier development is beginning to develop along the bayshore as land on the east side of roads is being developed in order to acquire a view of the bay. Older seasonal homes are being converted or replaced with larger permanent homes and homes back from the shore are having second floors added (BLRPC, 2001).

INVENTORY METHODS

Inventory data used in this study were collected using standard methodologies developed in 1974 by The Nature Conservancy for all Natural Heritage and Conservation Data Centre programs and coordinated today by NatureServe (Stein et al., 2000). This methodology is based on determining the location, condition, and status of units of natural diversity called "elements." Each documented instance of an element is termed an "element occurrence," and is referenced temporally as well as spatially. Elements include rare species, natural communities, natural features, and animal concentration areas such as bat hibernacula and bird rookeries. See Appendix 2 for more information on the NHI methodology.

Existing element occurrence records for the study area and surrounding lands and waters were extracted from the NHI database and reviewed early in the study. Throughout 1999-2001, inventories were completed on sites in the study area for rare plants, rare animals (including selected invertebrates), and natural communities. Target species and communities were selected from review of existing records and review of the NHI working list, a dynamic compilation of species and natural communities tracked by the NHI program that includes global and state ranks indicating degree of rarity. In 2001 more fine-tuned inventory was conducted and all data were subsequently mapped and computerized in the NHI database. See Appendix 3 for more information on the NHI working list and ranks.

A top-down, coarse filter-fine filter approach was used for the inventories. The initial analysis focused on natural communities and aquatic features present, their relative quality and condition, the surrounding landscape patterns, and current land use. Based upon existing habitat characteristics and known habitat preferences of various rare species, sites where species-specific surveys were most appropriate were identified. ***No doubt, occurrences of rare species exist that were not located through these inventories.*** However, by concentrating inventory efforts on Escarpment-related sites, it is most likely that populations of rare species with the highest conservation value were located.

In addition to standard NHI methodology, accepted scientific protocol and procedures for the various taxa were used during the Niagara Escarpment inventory. Specific methods used for each type of inventory conducted are as follows.

RARE PLANTS AND NATURAL COMMUNITIES

Principal Surveyors: Andy Clark, Dr. Emmet Judziewicz

Field inventory was conducted between July and October of 1999, and during the summers of 2000 and 2001. Over 50 major sites were inventoried including six state parks (High Cliff, Newport, Peninsula, Potawatomi, Rock Island, and Whitefish Dunes). Inventory targets included intact landscapes, plant communities, and selected rare vascular plants. Because of constraints imposed by the physical attributes of the Escarpment (sheer cliffs, talus), the primary survey method was the "meander survey technique", whereby as much of the site was covered as possible. This ensures that most, if not all, of the site variability and microhabitats present receive attention. Several sites were very small, or severely degraded, and field surveys were accordingly brief. An aerial survey of the Door Peninsula north of Sturgeon Bay was conducted by the NHI Ecologist in October, 2001. A list and description of natural community types associated with the Escarpment are provided in Appendix 4.

AQUATIC INVERTEBRATES

Surveyors: Dr. Kurt Schmude, Kathryn Kirk

The goal was to determine overall diversity and rare species components of aquatic habitats that are in some way influenced by proximity to the Niagara Escarpment. These sites were chosen to be surveyed because of their potentially unique and/or sensitive habitat and resident macroinvertebrate fauna, and/or because of the possible impact to the sites by actual or future land development. Emphasis was given to springs, seeps, small streams and wetlands in Door Co. Many of these sites were recommended by biologists familiar with the area. A concurrent study, funded by the U.S. Fish and Wildlife Service to locate additional populations of the Hine's emerald dragonfly, was coordinated with efforts here and is reported on separately (Kirk, 2002).

Running Water Sites. A total of 36 running water sites were sampled. At each site, the available habitats were determined, and each surveyor was responsible for a particular habitat(s). Sampling was performed using a D-frame aquatic net (approximately 1 mm mesh). The kick-sampling method was used in riffles and runs, while undercut banks were sampled by rigorously manipulating the net in the undercut substrates. Sample debris was placed on a large mesh screen over a large plastic tray, and the organisms fell through the mesh into the tray. Sample debris was then searched for cryptic, slow-moving organisms. All specimens were preserved in plastic vials containing 70% ethanol. Submerged structures (wood, rocks) were taken out of the water and inspected, and other habitats (water surface, shoreline) were visually inspected for organisms and exuviae. Habitats that were sampled included rocky riffles and runs, submerged wood and roots, undercut banks, submerged and emergent vegetation, sandy, silty, and/or clayey runs near the shoreline, surface (surface-dwelling organisms), and shorelines and bridges (exuviae).

Still Water Sites. A total of 16 still water sites were sampled. The available habitats were again determined, and each person was responsible for a particular habitat(s) or area(s) to sample. The same methods were employed. Habitats sampled included shallow vegetated areas, water column of deeper areas, submerged wood, shallow sandy/silty areas near the shoreline, surface, and shoreline searches for exuviae.

RARE BIRDS

Surveyor: Mike Grimm

Sites of expected or known high quality habitat that were especially representative of the Niagara Escarpment were selected for bird surveys. One hundred and ten point counts were made on 18 different properties. A wide range of habitats associated directly with the outcrops and bluffs of the Escarpment were selected. Habitats surveyed included vertical dolomite cliffs, upland hardwood or mixed hardwood-conifer forests at the Escarpment base, spring-fed white cedar swamps, and the thin-soiled boreal forests on dolomite along the Lake Michigan shoreline.

Three survey methods were used. At most sites a transect was established across the long axis of the survey site. Surveyors stopped at points located several hundred meters apart for 10 minutes to record all birds heard or seen. Incidental observations of birds observed between stops or flying over the site were recorded but kept separate from the more formal survey information. This method resulted in a set of 10 minute point counts for each survey site. Descriptive notes on vegetation, dominant plant species, and site condition were made at each observation point or during the return to the starting point. Where the sites were very small and/or time was limited a slow walk through the site was made, and all birds heard or seen were recorded. Lastly, one site was surveyed using a road-side count, following the methodology developed by the U.S. Fish and Wildlife Service for its continent-wide Breeding Bird Survey (3-minute observation points spaced one-half mile apart).

RARE TERRESTRIAL INVERTEBRATES

Surveyor: Kathy Kirk

Selected rare taxa from the insect Orders Lepidoptera, Heteroptera, Coleoptera, and Orthoptera were searched for in appropriate habitats. Sixty two sites were surveyed. Note that land snails were not field inventoried for this project. Survey sites were selected based on consultation with ecologists familiar with the area and in consideration of The Nature Conservancy and Door County Land Trust list of sensitive sites along the peninsula. Sites were chosen to sample a variety of Escarpment attributes such as rock structure, type and density of vegetation present, exposure, aspect, and latitude in order to represent all Escarpment habitat types available to the organisms in question. Lands in both public and private ownerships were included as accessibility and opportunity allowed. Some potential sites were visited early in the season and subsequently rejected as sampling sites.

All Escarpment sites, with the exception of one, were sampled by pitfall trapping. Traps were placed at the base of sheer faces, within the talus, or wedged into the rock as the situation allowed. Typically three traps were left at each site for 1 to 2 weeks. With few exceptions, trapping was conducted in late July. Collections were made from the rock ledges and faces by hand or aspirator at all sites. In addition, sweepnetting and handcollecting was conducted at two alvar sites.

ANALYSIS OF INVENTORY DATA

NHI staff scientists analyzed inventory data using GIS to determine which species and natural communities in the study area were specific to or most closely related to the presence of the bedrock, outcroppings, or other ecological attributes unique to the Escarpment. The species and natural communities surveyed during this project were placed in one of three classes:

Class 1. Those natural communities or rare plants or animals that are restricted to or strongly associated with near vertical or in certain cases, horizontal exposures of the Niagara Escarpment. This can include alvar communities, caves, sinkholes, crevices, talus slopes, and free face and rock ledges of the Escarpment.

Mesic forest, Rowley's Bay Trail. Photo by Gary Fewless.

Class 2. Those natural communities or rare plants or animals that are influenced by proximity with, but are not necessarily found directly on, vertical exposures of the Niagara Escarpment. Habitat and communities may include thin soiled, well drained dry-mesic to mesic forests above the free face, various spring-dependent wetlands below talus and wetlands on near-surface dolomitic bedrock, and mesic lake plain forests below talus. This also would include Great Lakes Alkaline rockshore. This class includes features that are concentrated in the study area and are largely absent from the remainder of Wisconsin.

Class 3. Those natural communities or rare plants or animals that happen to be in the study area but have many of their occurrences in other parts of Wisconsin. This can include a subset of features that may be calciphitic or otherwise associated with the influence of a calcareous substrate.

OVERALL RESULTS

The study documented 241 occurrences of rare species and natural communities (Map 5). Of these, 106 were animal occurrences, 99 were plants, and 36 were natural communities and other natural features. Nineteen were Class 1 occurrences, 28 were Class 2, and 194 were Class 3. Highlights are summarized below, with an emphasis on those elements closely related to the Escarpment (Class 1). Each of these elements relies strongly upon the unique features of the

Escarpment in order to sustain itself, and they are generally not found in other areas of Wisconsin. In some cases, the elements are globally rare. Study results are summarized by county in the next section.

NATURAL COMMUNITIES AND NATURAL FEATURES

The rock exposures of the Niagara Escarpment have created unusual environmental conditions that support distinctive assemblages of plants and animals. The Escarpment crosses a major climatic "tension zone" (Curtis, 1959), accounting for significant differences in the vegetation around and on the Escarpment. Historically, the northern stretches were embedded in a vast regional forest composed of a diverse mixture of hardwoods and conifers. From Kewaunee County south, prairie, oak savanna, and hardwood forests comprised the regional vegetation within which the Escarpment was situated.

Currently, the landscape around the Escarpment is highly altered by agricultural, residential, recreational, and industrial developments. Only on the Door Peninsula from the Sturgeon Bay area north do substantial remnants of natural vegetation remain. The most extensive of these remnants are forests, which at some locations still cover hundreds or thousands of contiguous acres. Important canopy trees include sugar maple, beech, basswood, white pine, white cedar, red pine, paper birch, hemlock, and balsam fir. Site conditions vary from dry to wet-mesic and as a result the mosaic of forest communities can be quite complex. Lake Michigan has influenced the climate of this area, resulting in cooler summers, warmer winters, and higher precipitation than at inland locations away from the Lake.

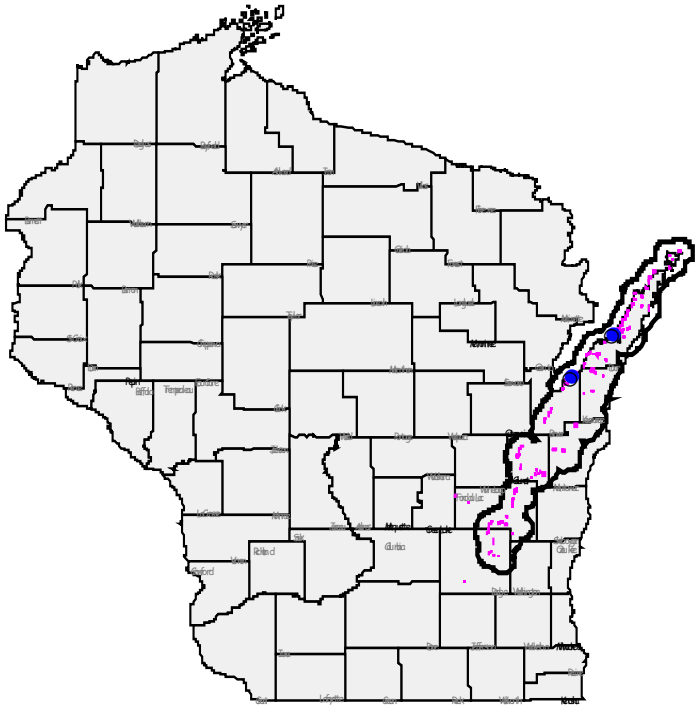
Farther south the natural vegetation is confined to the Escarpment itself, or may occur in small patches or extend in narrow strips along the Escarpment base or immediately above the rock. The "southern" forest composition consists of sugar maple, basswood, and beech on mesic sites, and mixtures dominated by oaks on drier sites. Red cedar is the only conifer regularly encountered along the southern portions of the Escarpment. No significant remnants of prairie or oak savanna communities have been documented in the immediate vicinity of the Escarpment.

Alvar. Alvar is a globally rare community found in North America only along Great Lakes shorelines (Map 6). Characteristics include thin, discontinuous soils over horizontal beds of limestone or dolomite, relatively low tree cover, and a distinctive biota that includes associates of rock pavement, prairie, oak savanna, and boreal forest communities. Among these are regional endemics, such as dwarf lake iris (*Iris lacustris*), restricted to the western Great Lakes region. Both coniferous and deciduous trees (cedar, fir, pine, oak, aspen, birch) may be scattered among an assemblage of other species that can include prairie plants like big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indian-grass (*Sorghastrum nutans*), and wood lily (*Lilium philadelphicum*), as well as shoreline plants such as silverweed (*Potentilla anserina*) and dwarf lake iris.

Free Face and Rock Ledges. Natural communities associated with the Escarpment face include alkaline dry cliffs, alkaline moist cliffs, seeps, and talus slopes. Along the Lake Michigan shoreline of the northern Door Peninsula, exposures of dolomite provide the substrate for alkaline rockshore, cobble beach, and wave-splashed cliff communities. Future vegetation sampling is planned to produce more detailed information on these bedrock communities.

Caves, sinkholes, and crevices. Many of the Escarpment cracks have become enlarged by dissolution, and the bedrock exhibits features such as caves and sinkholes. These features allow rapid infiltration and horizontal movement of groundwater, a phenomenon unique to karst areas in Wisconsin (Valvassori, 1990). Sinkholes and associated collapse features provide direct conduits for surface water to quickly reach underlying aquifers without filtration or storage. Ancient reef formations, rich in fossil deposits, are preserved locally in the dolomitic bedrock that forms the Escarpment.

Map 6. Distribution of Class 1 Natural Community Occurrences (Alvar)



Various Spring-dependent Wetlands Below Talus or Cliff Faces. At a few locations, water flowing through the dolomitic bedrock exits at or near the Escarpment base as spring runs or seepages. Wetland communities composed of swamp hardwoods, white cedar, and/or tall shrubs develop in these areas.

PLANTS

The variety of habitats developed by the karst topography, relative inaccessibility of cliff features, and calcareous soil conditions of the Escarpment create important conditions for the unusual expression of some common plant species and the presence of many species of rare plants. For example, old eastern red cedars (*Juniperus virginiana*) occur along the Escarpment, and an undisturbed cliff near Greenleaf in Brown County might have the oldest tree in Wisconsin. Dr. Douglas Larson, director of the Cliff Ecology Research Group at the University of Guelph, studied an eastern red cedar that he estimates to be over 1,200 years old (Larson et al, 1999). In fact, this individual tree may be the oldest red cedar tree in the world.

The Escarpment supplies critical habitat for a number of endangered, threatened, and rare plant species. Some species, including small white lady's-slipper (*Cypripedium candidum*), snow trillium (*Trillium nivale*), and low calamint (*Calamintha arkansana*), are found in other parts of the state but thrive on the calcareous substrates associated with the Escarpment. Other species,

such as elk sedge (*Carex garberi*), spoon-leaf moonwort (*Botrychium spathulatum*), and small-flowered grass-of-parnassus (*Parnassia parviflora)*, are found nowhere in Wisconsin but in close proximity to the Escarpment. Finally, the two species described below are dependent on bedrock exposures of the Escarpment for their existence in Wisconsin. The distribution of these Class 1 species and selected Class 2 and 3 species is shown on Map 7.

Draba arabisans (rock whitlow-grass) is a plant of Special Concern in Wisconsin. This species prefers exposed to shaded (often by white cedar) dolomite. Flowering occurs from mid-June through late July, and the optimal identification period is from early July to mid-September.

Draba lanceolata (lanceolate whitlow-cress) is a plant listed as Endangered in Wisconsin. This species prefers exposed dolomite. Flowering occurs from early May through mid-July, and the optimal identification period is from early May to late July.

Botrychium minganense, **Newport State Park, July 15, 2000. Photo by Tim Ditzman.**

ANIMALS

One of the most striking features of the Escarpment is the presence of rare land snails, some of which date back to the last Ice Age. These snails were widespread in the Pleictocene and are restricted now (in the Midwest) to cool moist microhabitats found primarily in the Niagara Escarpment and the Driftless Area. All but one of the animal species that are tied strongly to the Escarpment are land snails. Four of the six species restricted to areas influenced by the Escarpment are also land snails. Of the 100 or so species of land snail in Wisconsin almost a third are tracked by NHI and 7 are globally rare to globally imperiled (WDNR, 2001). About 20% of Wisconsin's land snail fauna are imperiled to critically imperiled in the state. Three species are currently protected as Endangered or Threatened. Most of these rare snails are species of cliffs and are either restricted to the Driftless Area of southwestern Wisconsin or the Niagara Escarpment of northeastern Wisconsin or both. A few species use woodlands or wetlands rather than cliffs. All of these rare snails are very small, with shell diameters of only a few millimeters.

The 16 species that are restricted to areas influenced by the Escarpment (Class 1 species) are described below, along with one Class 2 species (Hine's Emerald dragonfly) that is closely associated with the Escarpment. Other noteworthy animal-related features are also described. See Map 8 for distribution of these elements in Wisconsin.

Catinella gelida (a land snail), a State Special Concern snail. This species appears to be restricted to moist, soil covered ledges in the southern half of the study area, except for one record in Shawano County.

Glyphyalinia rhoadsi (sculpted glyph), a State Special Concern snail. This species is typically found in mesic woodlands near an alvar community. Five of the state's 6 known populations of this species occur in the northern half of the study area.

Glyphyalinia wheatleyi (bright glyph), a State Special Concern snail. This species is typically found in mesic woodlands and its only record in the state occurs in the middle of the Door Peninsula.

Hendersonia occulta (cherrystone drop), a State Threatened snail. This species is found on cliffs, algific slopes, and lakeshore woods. There are fifty-two populations documented in the state, thirty-five of which occur in the northern two-thirds of the study area.

Paravitrea multidentata (dentate supercoil), a State Special Concern snail. This species occurs primarily in deciduous forests in proximity to Lake Michigan and on cliffs along the Niagara Escarpment in eastern Wisconsin.

Pupoides albilabris (white-lip dagger), a State Special Concern snail. This species typically occurs in calcareous grasslands. The only known state occurrence of this species is in the middle of the study area in Brown County.

Striatura ferrea (black striate), a State Special Concern snail. This species is typically found in mesic woods in the northern half of the study area.

Striatura milium (fine-ribbed striate), a State Special Concern snail. This species typically occurs in mesic woods, cliffs, and algific slopes across its range. The only known state occurrence is in the northern half of the Door Peninsula.

Succinea bakeri (a land snail), a State Special Concern snail. This glacial endemic species occurs only along the Niagara Escarpment in eastern Wisconsin. It is restricted to cool carbonate talus slopes, cliffs, and algific slopes, often occurring with other glacial relict taxa.

Vallonia perspectiva (thin-lip vallonia), a State Special Concern snail. This species occurs primarily along calcareous cliffs in the southern half of the study area.

Vertigo elatior (tapered vertigo), a State Special Concern snail. This species occurs primarily in or near fens. They have been found in the northern half of the study area.

Vertigo hubrichti (midwest pleistocene vertigo), a State Endangered snail. This species occurs primarily on algific slopes and cliffs.

Vertigo iowaensis (Iowa pleistocene vertigo), a State Special Concern snail. This species occurs primarily on algific slopes and cliffs.

Vertigo nylanderi (deep-throated vertigo), a State Special Concern snail. This species is a rare calciphile found in swamp and alvar communties in the northern half of the study area.

Vertigo paradoxa (mystery vertigo), a State Special Concern snail. This species occurs primarily on cliffs.

Zoogenetes harpa (boreal top), a State Special Concern snail. This species occurs primarily on cliffs, and rocky and/or wet woods.

Somatochlora hineana (Hine's emerald dragonfly), a state endangered dragonfly, recently federally listed. The larval stage of the Hine's emerald is apparently restricted to spring-fed marshes, rivulets through emergent herbaceous vegetation, or small open water pools in the boreal rich fen community, where the water has groundwater sources, but may seasonally dry up. This may be due to the fact that most sites are perched just above dolomitic bedrock. Larvae may be dependent in some locations on the presence of crayfish burrows to survive summer drought or to over winter. Adults forage widely over surrounding areas and seem to prefer forest - open area edges. They rest in trees and shrubs and roost overnight in trees. The flight period extends from mid June through mid to late August. Door County has the largest population of this federally endangered species known.

Bat Hibernacula. One of the largest bat hibernacula in the Upper Midwest occurs at the Neda Mine State Natural Area (WDNR, 1989), near the southern end of the Niagara Escarpment. The caves, sinkhole features, and excavations associated with the former mine, provide summer roosting and winter hibernating sites for significant numbers of bats. Other areas of the Escarpment, e.g., at Door County's Peninsula State Park, are also known to harbor bats but the regional and local significance of these sites is unclear.

Migratory Bird Routes. While not directly dependent on the Escarpment, numerous migratory birds use the Escarpment in some way during their spring and fall migrations because it is congruent to shoreline. Waterfowl, particularly Canada Geese occupying nearby Horicon Marsh, may use the Escarpment as a "land mark" on return trips to the marsh.

Fish Spawning Areas. Submerged dolomite reefs and ledges off the Door Peninsula receive significant use by spawning whitefish (*Coregonus clupeaformis*) and other species.

INVENTORY RESULTS BY COUNTY

Inventory results are presented by county, arranged from north to south, within the study area. Each account includes a brief description of the study area within the county and a map of the county showing Escarpment outcroppings and occurrences of rare species and natural communities. The known element occurrences in each county are also presented in three tables based on the three classes: those dependent on the Escarpment (Class 1), those influenced by their proximity to the Escarpment (Class 2), and those that happen to be in the study area but are not necessarily dependent on the Escarpment (Class 3). Outagamie, Sheboygan, Washington, and Winnebago counties contain only insignificant portions of the study area and therefore are not described below.

DOOR COUNTY

Door County is almost entirely (97%) within the study area. The Niagara Escarpment is most prominent in Door County, with many outcroppings occurring along the eastern margin of Green Bay, along Lake Michigan in the northeastern part of the county, and on some of the larger islands making up the Grand Traverse archipelago.

The soils of Door County related to the Escarpment include rock outcrop and rock outcrop-Namur complex. This includes steep to nearly vertical exposures of dolomite bedrock, and stones on escarpments and talus slopes in areas where dolomite is exposed. Soils along these exposures are generally less than 12 inches thick and runoff is rapid. Namur soils have moderate runoff (U.S.D.A Soil Conservation Service, 1974).

Land use is highly variable. Residential development pressure is increasing, with shoreline areas or other sites with a lake view (e.g., the Escarpment!) especially vulnerable. Agricultural use is dominant in the interior of the county, and occurs at scattered locations elsewhere. Significant forests occur in Door county, most extensively near the Lake Michigan – Green Bay shorelines and often associated with areas that have thin soils overlying the dolomitic bedrock. There are five state parks in Door County and recreational use is extremely heavy. Several privately owned nature preserves are also present.

Door County is ecologically diverse, and many exceptional natural communities and rare species populations have been documented by biologists from public agencies, universities, and private conservation organizations. This county has the highest number of Class 1 rare species of any county in the study area. Many of the species are land snails of which at least two species are globally imperiled. One is the federally endangered Hine's emerald dragonfly which has the best populations here of anywhere in its range. Botanists have documented two species of whitlow-grass on cliffs in Door County that in Wisconsin are confined to the Escarpment. Not only is Door County rich in Class 1 species, but there are also many Class 2 and Class 3 rare plants and animals. Forty-one of the Class 2 and Class 3 species are listed as threatened or endangered by the state of Wisconsin, and four of these are on the Federal list of threatened or endangered species. Several plants, such as striped maple and broad-leaf sedge, are found nowhere else in Wisconsin. Door County has one of only two documented occurrences in the state of the globally unusual alvar community. The many high quality communities documented in Door County include Class 2 Great Lakes alkaline shorelands and talus forest. Some of the Class 3 communities are boreal rich fen, Great Lakes beach, interdunal wetlands, and shore fen. The rich array of rare species, natural communities, and special features is listed in the tables below.

Door County Elements *

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
1	Animal	*Glyphyalinia rhoadsi* (Sculpted glyph)	1997	S2	G5	SC/N	
1	Animal	*Glyphyalinia wheatleyi* (Bright glyph)	1995	S1	G5	SC/N	
1	Animal	*Hendersonia occulta* (Cherrystone drop)	1998	S3	G4	THR	
1	Animal	*Paravitrea multidentata* (Dentate supercoil)	1998	S2S3	G4G5	SC/N	
1	Animal	*Striatura ferrea* (Black striate)	1997	S2	G4G5	SC/N	
1	Animal	*Striatura milium* (Fine-ribbed striate)	1995	S4	G4		
1	Animal	*Succinea bakeri* (A land snail)	1997	SU	G?	SC/N	
1	Animal	*Vertigo elatior* (Tapered vertigo)	1997	S3	G?	SC/N	
1	Animal	*Vertigo hubrichti* (Midwest pleistocene vertigo)	1998	S1	G2	END	
1	Animal	*Vertigo iowaensis* (Iowa pleistocene vertigo)	1998	S1S2	G2	SC/N	
1	Animal	*Vertigo nylanderi* (Deep-throated vertigo)	1997	S1	G?	SC/N	
1	Animal	*Vertigo paradoxa* (Mystery vertigo)	1997	S1	G2G4	SC/N	
1	Animal	*Zoogenetes harpa* (Boreal top)	1997	S1	G?	SC/N	
1	Community	Alvar	2000	S1	G2	NA	
1	Plant	*Draba arabisans* (Rock whitlow-grass)	2000	S1	G4	SC	
1	Plant	*Draba lanceolata* (Lanceolate whitlow-cress)	1934	S1	G3G5	END	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
2	Animal	*Catinella exile* (Pleistocene catinella)	1995	S2	G1G2	SC/N	
2	Animal	*Cionella morseana* (Appalachian pillar)	1997	S2	G4G5	SC/N	
2	Animal	*Guppya sterkii* (Brilliant granule)	1997	S2S3	G4G5	SC/N	
2	Animal	*Orconectes propinquus* (Northern clearwater crayfish)	1999	SU	G5	SC/N	
2	Animal	*Somatochlora hineana* (Hine's emerald)	2001	S1	G2G3	END	LE
2	Animal	*Vitrina angelicae* (Transparent vitrine snail)	1996	S1	G?	SC/N	
2	Community	Great Lakes alkaline rockshore	2000	S2	G3	NA	
2	Community	Moist cliff	2000	S4		NA	
2	Community	Springs and spring runs, hard	1976	S4	GU	NA	
2	Community	Talus forest	1999	S1		NA	
2	Other	Bat hibernaculum	1986	S3		SC	
2	Plant	*Acer pensylvanicum* (Striped maple)	1998	S1	G5	SC	
2	Plant	*Asplenium viride* (Green spleenwort)	1999	S1	G4	END	
2	Plant	*Botrychium spathulatum* (Spoon-leaf moonwort)	1982	S1	G3	SC	
2	Plant	*Carex concinna* (Beautiful sedge)	1999	S1	G4G5	THR	
2	Plant	*Carex garberi* (Elk sedge)	2000	S1	G4	THR	
2	Plant	*Carex platyphylla* (Broad-leaf sedge)	2000	S2	G5	SC	
2	Plant	*Cirsium pitcheri* (Dune thistle)	2001	S2	G3	THR	LT
2	Plant	*Festuca occidentalis* (Western fescue)	2000	S1S2	G5	THR	
2	Plant	*Iris lacustris* (Dwarf lake iris)	2000	S2	G3	THR	LT
2	Plant	*Parnassia parviflora* (Small-flower grass-of-parnassus)	1995	S1	G4	END	
2	Plant	*Pterospora andromedea* (Giant pinedrops)	1999	S1	G5	END	
2	Plant	*Selaginella selaginoides* (Low spike-moss)	1994	S1	G5	END	
2	Plant	*Tanacetum huronense* (Lake Huron tansy)	1982	S1	G4G5	END	
2	Plant	*Trisetum melicoides* (Purple false oats)	1997	S1	G4	END	
2	Plant	*Viola rostrata* (Long-spur violet)	2000	S2	G5	SC	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Animal	*Accipiter gentilis* (Northern goshawk)	2000	S2N,S2B	G5	SC/M	
3	Animal	*Acipenser fulvescens* (Lake sturgeon)	1914	S3	G3G4	SC/H	
3	Animal	*Acris crepitans blanchardi* (Blanchard's cricket frog)	1983	S1	G5T5	END	
3	Animal	*Aeshna clepsydra* (Mottled darner)	1991	S2	G4	SC/N	
3	Animal	*Ammodramus henslowii* (Henslow's sparrow)	1994	S2S3B,SZN	G4	THR	
3	Animal	*Ammodramus leconteii* (Le Conte's sparrow)	1993	S2B,SZN	G4	SC/M	
3	Animal	*Ammodramus savannarum* (Grasshopper sparrow)	1998	S3B,SZN	G5	SC/M	
3	Animal	*Bartramia longicauda* (Upland sandpiper)	1984	S2B,SZN	G5	SC/M	
3	Animal	*Botaurus lentiginosus* (American bittern)	1998	S3B,SZN	G4	SC/M	
3	Animal	*Bucephala clangula* (Common goldeneye)	1997	S2B,SZN	G5	SC/M	
3	Animal	*Buteo lineatus* (Red-shouldered hawk)	1998	S1N,S3S4B	G5	THR	
3	Animal	*Caenis youngi* (A caenid mayfly)	1999	S2S3	G4	SC/N	
3	Animal	*Charadrius melodus* (Piping plover)	1948	S1	G3	END	LE
3	Animal	*Chromagrion conditum* (Aurora damselfly)	1991	S3	G5	SC/N	
3	Animal	*Cicindela hirticollis rhodensis* (Beach-dune tiger beetle)	1999	S2	G5T4	SC/N	

Door County Elements (Cont.)

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Animal	*Cordulegaster obliqua* (Arrowhead spiketail)	1999	S3	G4	SC/N	
3	Animal	*Coregonus artedi* (Lake herring)	1914	S3	G5	SC/N	
3	Animal	*Coturnicops noveboracensis* (Yellow rail)	1989	S1B,SZN	G4	THR	
3	Animal	*Cymbiodyta acuminata* (A water scavenger beetle)	1999	S3	G?	SC/N	
3	Animal	*Dendroica caerulescens* (Black-throated blue warbler)	1997	S3B,SZN	G5	SC/M	
3	Animal	*Dendroica tigrina* (Cape May warbler)	1999	S3B,SZN	G5	SC/M	
3	Animal	*Diadophis punctatus edwardsii* (Northern ringneck snake)	1991	S3?	G5T5	SC/H	
3	Animal	*Emydoidea blandingii* (Blanding's turtle)	1990	S3	G4	THR	
3	Animal	*Epiaeschna heros* (Swamp darner)	1993	S2S3	G5	SC/N	
3	Animal	*Euphyes bimacula* (Two-spotted skipper)	1982	S2S3	G4	SC/N	
3	Animal	*Euphyes dion* (Dion skipper)	1990	S3	G4	SC/N	
3	Animal	*Fundulus diaphanus* (Banded killifish)	1965	S3	G5	SC/N	
3	Animal	*Grammia oithona* (Oithona tiger moth)	1991	S2	G4	SC/N	
3	Animal	*Grammia phyllira* (Phyllira tiger moth)	1991	S2	G4	SC/N	
3	Animal	*Hydrobius melaenum* (A water scavenging beetle)	1999	SU	G?	SC/N	
3	Animal	*Hydrometra martini* (A water measurer)	1999	S3	G5	SC/N	
3	Animal	*Hydroporus vittatus* (A predaceous diving beetle)	1999	S3	G?	SC/N	
3	Animal	*Ilybius ignarus* (Diving beetle)	1999	S3	G?	SC/N	
3	Animal	*Ischnura hastata* (Citrine forktail)	1991	S2	G5	SC/N	
3	Animal	*Lanius ludovicianus* (Loggerhead shrike)	1983	S1B,SZN	G4	END	
3	Animal	*Lestes eurinus* (Amber-winged spreadwing)	1992	S3	G4	SC/N	
3	Animal	*Luxilus chrysocephalus* (Striped shiner)	1962	S1	G5	END	
3	Animal	*Lycaena dorcas* (Dorcas copper)	2000	S2	G5	SC/N	
3	Animal	*Matus bicarinatus* (A predaceous diving beetle)	1999	S2S3	G?	SC/N	
3	Animal	*Melanerpes erythrocephalus* (Red-headed woodpecker)	1982	S3B,SZN	G5	SC/M	
3	Animal	*Mergus merganser* (Common merganser)	1998	S3B,SZN	G5	SC/M	
3	Animal	*Mergus serrator* (Red-breasted merganser)	1998	S3B,SZN	G5	SC/M	
3	Animal	*Nycticorax nycticorax* (Black-crowned night-heron)	1979	S2B,SZN	G5	SC/M	
3	Animal	*Somatochlora elongata* (Ski-tailed emerald)	1990	S2S3	G5	SC/N	
3	Animal	*Somatochlora forcipata* (Forcipate emerald)	1990	S2S3	G5	SC/N	
3	Animal	*Somatochlora franklini* (Delicate emerald)	1991	S2S3	G5	SC/N	
3	Animal	*Sturnella neglecta* (Western meadowlark)	1992	S3S4B,SZN	G5	SC/M	
3	Animal	*Thamnophis sauritus* (Northern ribbon snake)	1963	S1?	G5	END	
3	Animal	*Trimerotropis huroniana* (Lake Huron locust)	1999	S1	G2G3	END	
3	Animal	*Vermivora peregrina* (Tennessee warbler)	1994	S1B,SZN	G5	SC/M	
3	Animal	*Vertigo morsei* (Six-whorl vertigo)	1997	S1	G?	SC/N	
3	Animal	*Wilsonia citrina* (Hooded warbler)	1995	S2B,SZN	G5	THR	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Community	Alder thicket	1976	S4	G4	NA	
3	Community	Boreal forest	2000	S2	G3?	NA	
3	Community	Boreal rich fen	2000	S2	G4G5	NA	
3	Community	Emergent aquatic	2000	S4	G4	NA	
3	Community	Forested ridge and swale	2001	S2	G3	NA	
3	Community	Forested seep	1998	S2		NA	
3	Community	Great lakes beach	1999	S2	G3	NA	
3	Community	Great lakes dune	2001	S2	G3	NA	
3	Community	Hardwood swamp	1999	S3	G4	NA	
3	Community	Interdunal wetland	1988	S1	G2?	NA	
3	Community	Lake--shallow, hard, drainage	2000	SU	GU	NA	
3	Community	Lake--shallow, hard, seepage	1998	SU	GU	NA	
3	Community	Lake--shallow, very hard, drainage (marl)	1988	S2	GU	NA	
3	Community	Northern dry-mesic forest	1999	S3	G4	NA	
3	Community	Northern mesic forest	2000	S4	G4	NA	
3	Community	Northern sedge meadow	2000	S3	G4	NA	
3	Community	Northern wet forest	1976	S4	G4	NA	
3	Community	Northern wet-mesic forest	2001	S3S4	G3?	NA	
3	Community	Open bog	1976	S4	G5	NA	
3	Community	Shore fen	2000	S2		NA	
3	Community	Shrub-carr	1999	S4	G5	NA	
3	Community	Southern hardwood swamp	1999	S2	G4?	NA	
3	Community	Southern mesic forest	1998	S3	G3?	NA	
3	Community	Southern sedge meadow	2000	S3	G4	NA	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Plant	*Adlumia fungosa* (Climbing fumitory)	2000	S3	G4	SC	
3	Plant	*Amerorchis rotundifolia* (Round-leaved orchis)	1985	S1	G5	THR	
3	Plant	*Arethusa bulbosa* (Swamp-pink)	1996	S3	G4	SC	

Door County Elements (Cont.)

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Plant	*Asplenium trichomanes* (Maidenhair spleenwort)	2000	S3	G5	SC	
3	Plant	*Astragalus neglectus* (Cooper's milkvetch)	2000	S1	G4	END	
3	Plant	*Botrychium lunaria* (Moonwort grape-fern)	1997	S1	G5	END	
3	Plant	*Botrychium minganense* (Mingan's moonwort)	1998	S2	G4	SC	
3	Plant	*Cakile edentula* (American sea-rocket)	2000	S3	G5	SC	
3	Plant	*Calamagrostis stricta* (Slim-stem small-reedgrass)	2000	S3	G5	SC	
3	Plant	*Calamintha arkansana* (Low calamint)	2000	S2	G5	SC	
3	Plant	*Calamovilfa longifolia* var *magna* (Sand reed-grass)	2000	S2	G5T3T5	THR	
3	Plant	*Calypso bulbosa* (Fairy slipper)	1973	S3	G5	THR	
3	Plant	*Cardamine pratensis* (Cuckooflower)	2000	S3	G5	SC	
3	Plant	*Carex backii* (Rocky Mountain sedge)	1916	S2	G4	SC	
3	Plant	*Carex capillaris* (Hair-like sedge)	2000	S1	G5	SC	
3	Plant	*Carex crawei* (Crawe sedge)	2000	S3	G5	SC	
3	Plant	*Carex exilis* (Coast sedge)	1998	S1	G5	THR	
3	Plant	*Carex formosa* (Handsome sedge)	2000	S2	G4	THR	
3	Plant	*Carex gynocrates* (Northern bog sedge)	2000	S2	G5	SC	
3	Plant	*Carex livida* var *radicaulis* (Livid sedge)	2000	S2	G5T5	SC	
3	Plant	*Carex prasina* (Drooping sedge)	1999	S2S3	G4	THR	
3	Plant	*Carex richardsonii* (Richardson sedge)	2000	S3	G4	SC	
3	Plant	*Carex vaginata* (Sheathed sedge)	2000	S1	G5	SC	
3	Plant	*Corallorhiza odontorhiza* (Autumn coral-root)	1998	S3	G5	SC	
3	Plant	*Cypripedium arietinum* (Ram's-head lady's-slipper)	1997	S2	G3	THR	
3	Plant	*Cypripedium parviflorum* (Small yellow lady's-slipper)	1999	S3	G5	SC	
3	Plant	*Cypripedium reginae* (Showy lady's-slipper)	2000	S3	G4	SC	
3	Plant	*Deschampsia cespitosa* (Tufted hairgrass)	2000	S3	G5	SC	
3	Plant	*Deschampsia flexuosa* (Crinkled hairgrass)	2000	S3	G5	SC	
3	Plant	*Drosera linearis* (Slenderleaf sundew)	1995	S1	G4	THR	
3	Plant	*Dryopteris expansa* (Spreading woodfern)	1997	S1	G5	SC	
3	Plant	*Eleocharis quinqueflora* (Few-flower spikerush)	2000	S2	G5	SC	
3	Plant	*Elymus lanceolatus* ssp *psammophilus* (Thickspike)	2000	S2	G5T3	THR	
3	Plant	*Epilobium palustre* (Marsh willow-herb)	1983	S3	G5	SC	
3	Plant	*Epilobium strictum* (Downy willow-herb)	1926	S2S3	G5?	SC	
3	Plant	*Equisetum palustre* (Marsh horsetail)	1983	S2	G5	SC	
3	Plant	*Equisetum variegatum* (Variegated horsetail)	2000	S3	G5	SC	
3	Plant	*Euphorbia polygonifolia* (Seaside spurge)	2000	S2	G5?	SC	
3	Plant	*Gentianopsis procera* (Lesser fringed gentian)	2000	S3	G5	SC	
3	Plant	*Geocaulon lividum* (Northern comandra)	1999	S1	G5	END	
3	Plant	*Gymnocarpium robertianum* (Limestone oak fern)	1979	S2	G5	SC	
3	Plant	*Leucophysalis grandiflora* (Large-flowered ground-cherry)	2001	S2	G3?	SC	
3	Plant	*Malaxis brachypoda* (White adder's-mouth)	2000	S3	G4Q	SC	
3	Plant	*Medeola virginiana* (Indian cucumber-root)	1931	S3	G5	SC	
3	Plant	*Ophioglossum pusillum* (Adder's-tongue)	1950	S3	G5	SC	
3	Plant	*Orobanche uniflora* (One-flowered broomrape)	2001	S3	G5	SC	
3	Plant	*Osmorhiza chilensis* (Chilean sweet cicely)	1999	S3	G5	SC	
3	Plant	*Platanthera dilatata* (Leafy white orchis)	1999	S3	G5	SC	
3	Plant	*Platanthera flava* var *herbiola* (Pale green orchid)	1987	S2	G4T4Q	THR	
3	Plant	*Platanthera hookeri* (Hooker orchis)	1998	S3	G5	SC	
3	Plant	*Platanthera orbiculata* (Large roundleaf orchid)	2000	S3	G5?	SC	
3	Plant	*Polystichum acrostichoides* (Christmas fern)	1975	S2	G5	SC	
3	Plant	*Primula mistassinica* (Bird's-eye primrose)	2000	S3	G5	SC	
3	Plant	*Ranunculus gmelinii* (Small yellow water crowfoot)	1938	S1	G5	END	
3	Plant	*Rhynchospora fusca* (Brown beakrush)	1999	S2	G4G5	SC	
3	Plant	*Ribes hudsonianum* (Northern black currant)	1999	S3	G5	SC	
3	Plant	*Ribes oxyacanthoides* (Canada gooseberry)	1926	S1	G5	THR	
3	Plant	*Scirpus cespitosus* (Tufted club-rush)	1999	S2	G5	THR	
3	Plant	*Senecio congestus* (Marsh ragwort)	1935	SH	G5	SC	
3	Plant	*Solidago ohioensis* (Ohio goldenrod)	2000	S3	G4	SC	
3	Plant	*Solidago simplex* var *gillmanii* (Sticky goldenrod)	2000	S2	G5T3?	THR	
3	Plant	*Tofieldia glutinosa* (Sticky false-asphodel)	1999	S3	G5	THR	
3	Plant	*Triglochin maritima* (Common bog arrow-grass)	2000	S3	G5	SC	
3	Plant	*Triglochin palustris* (Slender bog arrow-grass)	2000	S3	G5	SC	
3	Plant	*Utricularia geminiscapa* (Hidden-fruited bladderwort)	1972	S3	G4G5	SC	

* See Appendix 3 for an explanation of NHI status' and rankings

KEWAUNEE COUNTY

As with Calumet and Door counties, most (96%) of Kewaunee County is in the study area. Outcrops of the Escarpment are concentrated in the northern two-thirds of the western two-thirds of the county. There are scattered outcrops in the southern one-fifth of Kewaunee County.

As is typical of the other counties in the study area, land use in Kewaunee County is a mixture of agriculture, forest, and development. Within the study area, there is heavy residential and commercial development in the northwest corner of the county along Green Bay.

Compared to other counties that are mostly within the study area, Kewaunee County has relatively few Class 1 species. All of the Class 1 species are land snails, one of which may be globally imperiled. There are two Class 2 animal species and one Class 2 plant species in the study area. One of the animals, Hine's emerald dragonfly, is listed as endangered both by Wisconsin and the Federal government. Six of the Class 3 animal and plant species documented in Kewaunee County are listed as endangered or threatened in Wisconsin. BER staff documented relatively few high quality natural communities in the county, but they included a Class 2 moist cliff and Class 3 emergent aquatic and southern mesic forest communities, among others. The rare species and natural communities are listed in the tables below.

Kewaunee County Elements*

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
1	Animal	*Hendersonia occulta* (Cherrystone drop)	1997	S3	G4	THR	
1	Animal	*Paravitrea multidentata* (Dentate supercoil)	1997	S2S3	G4G5	SC/N	
1	Animal	*Vertigo elatior* (Tapered vertigo)	1997	S3	G?	SC/N	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
2	Animal	*Somatochlora hineana* (Hine's emerald)	2001	S1	G2G3	END	LE
2	Animal	*Vitrina angelicae* (Transparent vitrine snail)	1996	S1	G?	SC/N	
2	Plant	*Viola rostrata* (Long-spur violet)	1994	S2	G5	SC	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Animal	*Ammodramus savannarum* (Grasshopper sparrow)	1999	S3B,SZN	G5	SC/M	
3	Animal	*Clinostomus elongatus* (Redside dace)	1994	S3	G4	SC/N	
3	Animal	*Euphyes bimacula* (Two-spotted skipper)	1984	S2S3	G4	SC/N	
3	Animal	*Fundulus diaphanus* (Banded killifish)	1965	S3	G5	SC/N	
3	Animal	*Lepomis megalotis* (Longear sunfish)	1906	S2	G5	THR	
3	Animal	*Moxostoma valenciennesi* (Greater redhorse)	1980	S2S3	G4	THR	
3	Animal	*Notropis anogenus* (Pugnose shiner)	1906	S2S3	G3	THR	
3	Animal	*Strobilops affinis* (Eightfold pinecone)	1997	S3	G?	SC/N	
3	Animal	*Tyto alba* (Barn owl)	1965	S1B,S1N	G5	END	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Community	Alder thicket	1976	S4	G4	NA	
3	Community	Emergent aquatic	1976	S4	G4	NA	
3	Community	Floodplain forest	1978	S3	G3?	NA	
3	Community	Hardwood swamp	2001	S3	G4	NA	
3	Community	Lake--deep, hard, seepage	1976	S2	GU	NA	
3	Community	Northern mesic forest	2000	S4	G4	NA	
3	Community	Northern sedge meadow	1978	S3	G4	NA	
3	Community	Northern wet forest	1978	S4	G4	NA	
3	Community	Northern wet-mesic forest	2001	S3S4	G3?	NA	
3	Community	Open bog	1978	S4	G5	NA	
3	Community	Shrub-carr	1978	S4	G5	NA	

Kewaunee County Elements (Cont.)

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Plant	*Aster furcatus* (Forked aster)	1892	S1S2	G3	THR	
3	Plant	*Cakile edentula* (American sea-rocket)	1971	S3	G5	SC	
3	Plant	*Calamagrostis stricta* (Slim-stem small-reedgrass)	1892	S3	G5	SC	
3	Plant	*Cardamine pratensis* (Cuckooflower)	1937	S3	G5	SC	
3	Plant	*Cypripedium parviflorum* (Small yellow lady's-slipper)	2001	S3	G5	SC	
3	Plant	*Cypripedium reginae* (Showy lady's-slipper)	2001	S3	G4	SC	
3	Plant	*Equisetum variegatum* (Variegated horsetail)	2001	S3	G5	SC	
3	Plant	*Erigenia bulbosa* (Harbinger-of-spring)	2000	S1	G5	END	
3	Plant	*Euphorbia polygonifolia* (Seaside spurge)	1932	S2	G5?	SC	
3	Plant	*Jeffersonia diphylla* (Twinleaf)	1994	S2	G5	SC	
3	Plant	*Lithospermum latifolium* (American gromwell)	2000	S3	G4	SC	
3	Plant	*Polystichum acrostichoides* (Christmas fern)	1995	S2	G5	SC	

* See Appendix 3 for an explanation of NHI status' and rankings

BROWN COUNTY

Approximately 69% of Brown County lies within the study area. Exposures of the Niagara Escarpment run from the northeast to the southwest part of the county.

Brown County is one the most populated counties in the study area, particularly in the Green Bay area. Consequently, land use is variable, with heavy development pressure in the vicinity of the City of Green Bay. The remainder of the study area in Brown County is a mixture of small forest patches, agriculture, low density housing, and quarry operations of differing sizes.

There are a number of significant endangered resources in Brown County. One of only two known occurrences of the alvar natural community has been described in Brown County. The microclimate resulting from the geology of the Niagara Escarpment harbors a variety of rare and unusual land snails, including several species that are globally imperiled. Many other high quality natural communities and rare species occur near and are influenced by the Escarpment. These include the Class 2 moist cliff and several Class 3 communities such as forested ridge and swale, northern dry-mesic forest, and stream-slow, hard, warm. There are 16 Class 2 and 3 plants and animals that are listed as endangered or threatened by Wisconsin, including one species, the dwarf lake iris, that is listed as threatened by the federal government. The species and natural communities are listed in the three tables below.

Brown County Elements*

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
1	Animal	*Catinella gelida* (A land snail)	1998	S1S2	G2	SC/N	
1	Animal	*Glyphyalinia rhoadsi* (Sculpted glyph)	1995	S2	G5	SC/N	
1	Animal	*Hendersonia occulta* (Cherrystone drop)	1998	S3	G4	THR	
1	Animal	*Paravitrea multidentata* (Dentate supercoil)	1998	S2S3	G4G5	SC/N	
1	Animal	*Pupoides albilabris* (White-lip dagger)	1995	S3	G5	SC/N	
1	Animal	*Striatura ferrea* (Black striate)	1998	S2	G4G5	SC/N	
1	Animal	*Succinea bakeri* (A land snail)	1998	SU	G?	SC/N	
1	Animal	*Vertigo elatior* (Tapered vertigo)	1998	S3	G?	SC/N	
1	Animal	*Vertigo hubrichti* (Midwest pleistocene vertigo)	1997	S1	G2	END	
1	Animal	*Vertigo iowaensis* (Iowa pleistocene vertigo)	1997	S1S2	G2	SC/N	
1	Animal	*Vertigo nylanderi* (Deep-throated vertigo)	1998	S1	G?	SC/N	
1	Community	Alvar	1999	S1	G2	NA	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
2	Animal	*Guppya sterkii* (Brilliant granule)	1997	S2S3	G4G5	SC/N	
2	Community	Moist cliff	1982	S4		NA	
2	Other	Migratory bird concentration site	1988	SU		SC	
2	Plant	*Iris lacustris* (Dwarf lake iris)	2001	S2	G3	THR	LT
2	Plant	*Viola rostrata* (Long-spur violet)	1970	S2	G5	SC	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Animal	*Acipenser fulvescens* (Lake sturgeon)		S3	G3G4	SC/H	
3	Animal	*Acris crepitans blanchardi* (Blanchard's cricket frog)	1983	S1	G5T5	END	
3	Animal	*Aeshna verticalis* (Green-striped darner)	1999	S3	G5	SC/N	
3	Animal	*Ammodramus savannarum* (Grasshopper sparrow)	1997	S3B,SZN	G5	SC/M	
3	Animal	*Anguilla rostrata* (American eel)	1974	S1S2	G5	SC/N	
3	Animal	*Ardea alba* (Great egret)	2001	S1B,SZN	G5	THR	
3	Animal	*Aythya americana* (Redhead)	1995	S2B,SZN	G5	SC/M	
3	Animal	*Bartramia longicauda* (Upland sandpiper)	1998	S2B,SZN	G5	SC/M	

Brown County Elements (Cont.)

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Animal	*Clemmys insculpta* (Wood turtle)	1992	S3	G4	THR	
3	Animal	*Clinostomus elongatus* (Redside dace)	1994	S3	G4	SC/N	
3	Animal	*Cymbiodyta acuminata* (A water scavenger beetle)	1999	S3	G?	SC/N	
3	Animal	*Egretta thula* (Snowy egret)	1996	S1B,SZN	G5	END	
3	Animal	*Erynnis martialis* (Mottled dusky wing)	1985	S2	G3G4	SC/N	
3	Animal	*Euphyes bimacula* (Two-spotted skipper)	1981	S2S3	G4	SC/N	
3	Animal	*Euphyes dion* (Dion skipper)	1984	S3	G4	SC/N	
3	Animal	*Lepomis megalotis* (Longear sunfish)	1973	S2	G5	THR	
3	Animal	*Moxostoma valenciennesi* (Greater redhorse)	1989	S2S3	G4	THR	
3	Animal	*Nycticorax nycticorax* (Black-crowned night-heron)	1997	S2B,SZN	G5	SC/M	
3	Animal	*Pandion haliaetus* (Osprey)	1997	S3S4B,SZN	G5	THR	
3	Animal	*Pelecanus erythrorhynchos* (American white pelican)	2001	S1B,S1N	G3	SC/M	
3	Animal	*Poanes massasoit* (Mulberry wing)	1984	S3	G4	SC/N	
3	Animal	*Poanes viator* (Broad-winged skipper)	1984	S3	G5	SC/N	
3	Animal	*Spiza americana* (Dickcissel)	1997	S3B,SZN	G5	SC/M	
3	Animal	*Sterna caspia* (Caspian tern)	1997	S1B,S2N	G5	END	
3	Animal	*Sterna forsteri* (Forster's tern)	1997	S2B,SZN	G5	END	
3	Animal	*Sterna hirundo* (Common tern)	1997	S1B,S2N	G5	END	
3	Animal	*Strobilops affinis* (Eightfold pinecone)	1998	S3	G?	SC/N	
3	Animal	*Sturnella neglecta* (Western meadowlark)	1997	S3S4B,SZN	G5	SC/M	
3	Animal	*Vertigo tridentata* (Honey vertigo)	1996	S3	G4G5	SC/N	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Community	Forested ridge and swale	1996	S2	G3	NA	
3	Community	Lake--shallow, hard, seepage	1982	SU	GU	NA	
3	Community	Northern dry-mesic forest	1982	S3	G4	NA	
3	Community	Northern mesic forest	1982	S4	G4	NA	
3	Community	Northern wet forest	1982	S4	G4	NA	
3	Community	Northern wet-mesic forest	2001	S3S4	G3?	NA	
3	Community	Southern dry-mesic forest	1990	S3	G4	NA	
3	Community	Southern mesic forest	1996	S3	G3?	NA	
3	Community	Stream--slow, hard, warm	1978	SU		NA	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Plant	*Adlumia fungosa* (Climbing fumitory)	2001	S3	G4	SC	
3	Plant	*Armoracia lacustris* (Lake-cress)	1891	S1	G4?	END	
3	Plant	*Cakile edentula* (American sea-rocket)	1989	S3	G5	SC	
3	Plant	*Cardamine pratensis* (Cuckooflower)	1982	S3	G5	SC	
3	Plant	*Carex crawei* (Crawe sedge)	1999	S3	G5	SC	
3	Plant	*Carex formosa* (Handsome sedge)	2001	S2	G4	THR	
3	Plant	*Carex richardsonii* (Richardson sedge)	1999	S3	G4	SC	
3	Plant	*Cypripedium parviflorum* (Small yellow lady's-slipper)	2001	S3	G5	SC	
3	Plant	*Eleocharis compressa* (Flat-stemmed spike-rush)	1987	S2	G4	SC	
3	Plant	*Gentiana alba* (Yellow gentian)	2000	S3	G4	THR	
3	Plant	*Gymnocarpium robertianum* (Limestone oak fern)	1993	S2	G5	SC	
3	Plant	*Lithospermum latifolium* (American gromwell)	1994	S3	G4	SC	
3	Plant	*Malaxis brachypoda* (White adder's-mouth)	1879	S3	G4Q	SC	
3	Plant	*Onosmodium molle* (Marbleseed)	1993	S3	G4G5	SC	
3	Plant	*Plantago cordata* (Heart-leaved plantain)	1888	S1	G4	END	
3	Plant	*Strophostyles leiosperma* (Small-flowered woolly bean)	1888	S2	G5	SC	
3	Plant	*Trillium nivale* (Snow trillium)	1996	S3	G4	THR	

* See Appendix 3 for an explanation of NHI status' and rankings

MANITOWOC COUNTY

About 59% of Manitowoc County is in the Niagara Escarpment study area. The Escarpment outcroppings are restricted to the north-central and west-central parts of the county. Land use in the county is a mix of agriculture, forest, and development. The major cities are Manitowoc and Two Rivers.

Only two Class 1 species have been documented on the outcrops of the Escarpment in Manitowoc County. Both species are land snails one of which is listed as endangered and the other as threatened in Wisconsin. Each species has been found in only three to four other counties in the study area. Of the 17 Class 2 or Class 3 rare species in the study area, six have been listed as endangered or threatened by the state of Wisconsin. The county has several high quality examples of natural communities, including Class 2 moist cliff and Class 3 communities like lake-soft bog and northern mesic forest. The various species, natural communities, and special features are listed in the three tables below.

Manitowoc County Elements*

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
1	Animal	*Hendersonia occulta* (Cherrystone drop)	1997	S3	G4	THR	
1	Animal	*Vertigo hubrichti* (Midwest pleistocene vertigo)	1996	S1	G2	END	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
2	Community	Moist cliff	1977	S4		NA	
2	Other	Bat hibernaculum	1990	S3		SC	
2	Plant	*Viola rostrata* (Long-spur violet)	1918	S2	G5	SC	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Animal	*Buteo lineatus* (Red-shouldered hawk)	1973	S1N,S3S4B	G5	THR	
3	Animal	*Clinostomus elongatus* (Redside dace)	1994	S3	G4	SC/N	
3	Animal	*Crangonyx gracilis* (A side-swimmer)	1994	SU	G4	SC/N	
3	Animal	*Crangonyx richmondensis* (A side-swimmer)	1994	SU	G?	SC/N	
3	Animal	*Lythrurus umbratilis* (Redfin shiner)	1956	S3	G5	THR	
3	Animal	*Moxostoma valenciennesi* (Greater redhorse)	1983	S2S3	G4	THR	
3	Animal	*Nycticorax nycticorax* (Black-crowned night-heron)	1978	S2B,SZN	G5	SC/M	
3	Animal	*Pandion haliaetus* (Osprey)	1990	S3S4B,SZN	G5	THR	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Community	Lake--soft bog	1978	S4	GU	NA	
3	Community	Northern mesic forest	1978	S4	G4	NA	
3	Community	Northern wet forest	1979	S4	G4	NA	
3	Community	Northern wet-mesic forest	1978	S3S4	G3?	NA	
3	Community	Open bog	1978	S4	G5	NA	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Plant	*Adlumia fungosa* (Climbing fumitory)	1977	S3	G4	SC	
3	Plant	*Arethusa bulbosa* (Swamp-pink)	1929	S3	G4	SC	
3	Plant	*Diplazium pycnocarpon* (Glade fern)	1900	S2	G5	SC	
3	Plant	*Jeffersonia diphylla* (Twinleaf)	1994	S2	G5	SC	
3	Plant	*Lithospermum latifolium* (American gromwell)	1994	S3	G4	SC	
3	Plant	*Medeola virginiana* (Indian cucumber-root)	1923	S3	G5	SC	
3	Plant	*Poa paludigena* (Bog bluegrass)	1960	S2S3	G3	THR	
3	Plant	*Trillium nivale* (Snow trillium)	1993	S3	G4	THR	

* See Appendix 3 for an explanation of NHI status' and rankings

CALUMET COUNTY

The vast majority (about 95%) of Calumet County is in the study area. The Niagara Escarpment outcrops are concentrated in the southwestern two-thirds of the county, especially along the east shore of Lake Winnebago, with scattered outcrops in the northeast.

Land use in the study area includes agriculture and forest with some rural residential development. A large tract of forest exists south from Sherwood to High Cliff State Park. There is considerable development in the study area along Lake Winnebago in western Calumet County.

Survey work was successful in locating new populations of several species of rare Class 1 land snails, including one that is globally imperiled. Three high quality examples of Class 2 natural communities (moist and dry cliffs, talus forest) have been documented in the county as well as a bat hibernaculum. The natural communities are dependent on the properties of the geology that results in the formation of cliffs and talus slopes. Class 3 communities include emergent marsh, floodplain forest, and open bogs. There is seven Class 2 or 3 species that are listed as endangered or threatened by Wisconsin. The natural communities and species are listed in the three tables below.

Calumet County Elements*

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
1	Animal	*Catinella gelida* (A land snail)	1998	S1S2	G2	SC/N	
1	Animal	*Paravitrea multidentata* (Dentate supercoil)	1996	S2S3	G4G5	SC/N	
1	Animal	*Succinea bakeri* (A land snail)	1998	SU	G?	SC/N	
1	Animal	*Vallonia perspectiva* (Thin-lip vallonia)	1998	S3	G4G5	SC/N	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
2	Community	Dry cliff	1983	S4		NA	
2	Community	Moist cliff	1983	S4		NA	
2	Community	Talus forest	1999	S1		NA	
2	Other	Bat hibernaculum	1986	S3		SC	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Animal	*Acris crepitans blanchardi* (Blanchard's cricket frog)	1982	S1	G5T5	END	
3	Animal	*Coturnicops noveboracensis* (Yellow rail)	1991	S1B,SZN	G4	THR	
3	Animal	*Crangonyx gracilis* (A side-swimmer)	1994	SU	G4	SC/N	
3	Animal	*Diadophis punctatus edwardsii* (Northern ringneck snake)	1986	S3?	G5T5	SC/H	
3	Animal	*Moxostoma valenciennesi* (Greater redhorse)	1979	S2S3	G4	THR	
3	Animal	*Poanes viator* (Broad-winged skipper)	1990	S3	G5	SC/N	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Community	Emergent aquatic	1982	S4	G4	NA	
3	Community	Floodplain forest	1979	S3	G3?	NA	
3	Community	Northern wet forest	1982	S4	G4	NA	
3	Community	Open bog	1982	S4	G5	NA	
3	Community	Shrub-carr	1982	S4	G5	NA	
3	Community	Southern mesic forest	2000	S3	G3?	NA	

Calumet County Elements (Cont.)

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Plant	*Arabis shortii* (Short's rock-cress)	1994	S2	G5	SC	
3	Plant	*Cypripedium arietinum* (Ram's-head lady's-slipper)	1891	S2	G3	THR	
3	Plant	*Gentiana alba* (Yellow gentian)	1992	S3	G4	THR	
3	Plant	*Polytaenia nuttallii* (Prairie parsley)	1848	S3	G5	THR	
3	Plant	*Trillium nivale* (Snow trillium)	1995	S3	G4	THR	

* See Appendix 3 for an explanation of NHI status' and rankings

FOND DU LAC COUNTY

About half (52%) of Fond du Lac County is in the study area. The Escarpment runs north to south in about the central third of the county, and is a prominent feature near the southeastern shore of Lake Winnebago and southwest of the village of Oakfield. There are scattered outcrops near the western border of Fond du Lac County.

Land use is predominantly agricultural and residential, with very limited timber management occurring in a few areas. Within the study area, development is most extensive in and around the City of Fond du Lac and along the busy the USH 41 corridor. Development is also concentrated along the Lake Winnebago shoreline.

Although Fond du Lac County was not surveyed as thoroughly as most of the other counties, five Class 1 animal species and one Class 1 plant have been documented. The animal populations are all land snails that depend on the microclimate created by the Escarpment. At least two of the snail species are considered globally imperiled. In Wisconsin, rock whitlow-grass has been nowhere but on the cliffs of the Escarpment. Nineteen other high quality examples of natural communities and rare species, including five species listed as threatened in Wisconsin, have been found in Fond du Lac County. The natural communities include a Class 2 moist cliff, a Class 2 dry cliff, and Class 3 floodplain forest, southern sedge meadow, and mesic prairie, among others. The rare species and natural communities are outlined in the tables below.

Fond du Lac County Elements*

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
1	Animal	*Catinella gelida* (A land snail)	1997	S1S2	G2	SC/N	
1	Animal	*Succinea bakeri* (A land snail)	1997	SU	G?	SC/N	
1	Animal	*Vallonia perspectiva* (Thin-lip vallonia)	1997	S3	G4G5	SC/N	
1	Animal	*Vertigo hubrichti* (Midwest pleistocene vertigo)	1997	S1	G2	END	
1	Animal	*Vertigo iowaensis* (Iowa pleistocene vertigo)	1997	S1S2	G2	SC/N	
1	Plant	*Draba arabisans* (Rock whitlow-grass)	2000	S1	G4	SC	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
2	Community	Moist cliff	2000	S4		NA	
2	Community	Dry cliff					

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Animal	*Acipenser fulvescens* (Lake sturgeon)		S3	G3G4	SC/H	
3	Animal	*Emydoidea blandingii* (Blanding's turtle)	1995	S3	G4	THR	
3	Animal	*Erimyzon sucetta* (Lake chubsucker)	1973	S3	G5	SC/N	
3	Animal	*Lythrurus umbratilis* (Redfin shiner)	1972	S3	G5	THR	
3	Animal	*Vertigo tridentata* (Honey vertigo)	1997	S3	G4G5	SC/N	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Community	Emergent aquatic	1979	S4	G4	NA	
3	Community	Floodplain forest	1978	S3	G3?	NA	
3	Community	Lake--shallow, hard, drainage	1978	SU	GU	NA	
3	Community	Mesic prairie	1988	S1	G2	NA	
3	Community	Northern wet forest	1978	S4	G4	NA	
3	Community	Shrub-carr	1979	S4	G5	NA	
3	Community	Southern mesic forest	1978	S3	G3?	NA	
3	Community	Southern sedge meadow	1979	S3	G4	NA	

Fond du Lac County Elements (Cont.)

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Plant	*Asclepias sullivantii* (Prairie milkweed)	1987	S2	G5	THR	
3	Plant	*Aster furcatus* (Forked aster)	2001	S1S2	G3	THR	
3	Plant	*Calamagrostis stricta* (Slim-stem small-reedgrass)	1938	S3	G5	SC	
3	Plant	*Cypripedium candidum* (Small white lady's-slipper)	1873	S3	G4	THR	
3	Plant	*Cypripedium parviflorum* (Small yellow lady's-slipper)	1970	S3	G5	SC	

* See Appendix 3 for an explanation of NHI status' and rankings

DODGE COUNTY

About 29% of Dodge County is in the study area. The most significant outcrops of the Escarpment are in the northeast part of the county, with scattered outcrops elsewhere outside of the study area.

The land use in Dodge County includes agriculture and forest. Development in the study area is centered on the cities and villages, with scattered rural residential development elsewhere. The Escarpment is quarried at several locations, with a large operation at the intersection of STH 67 and 33.

A number of high quality natural communities, special features, and rare species have been documented in the study area in Dodge County. High quality natural communities include a Class 2 moist cliff, Class 2 dry cliff, and Class 3 emergent aquatics and southern mesic forest. A Class 2 special feature, a bat hibernaculum, has been documented in the study area. All of the Class 1 rare species are land snails, including three species that are globally imperiled. Three of the Class 3 rare taxa are listed as endangered or threatened by the State of Wisconsin. The natural communities, special features, and rare species are listed in the tables below.

Dodge County Elements*

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
1	Animal	*Catinella gelida* (A land snail)	1997	S1S2	G2	SC/N	
1	Animal	*Succinea bakeri* (A land snail)	1997	SU	G?	SC/N	
1	Animal	*Vallonia perspectiva* (Thin-lip vallonia)	1997	S3	G4G5	SC/N	
1	Animal	*Vertigo hubrichti* (Midwest pleistocene vertigo)	1996	S1	G2	END	
1	Animal	*Vertigo iowaensis* (Iowa pleistocene vertigo)	1996	S1S2	G2	SC/N	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
2	Community	Moist cliff	2000	S4		NA	
2	Community	Dry cliff					
2	Other	Bat hibernaculum	1992	S3		SC	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Animal	*Acris crepitans blanchardi* (Blanchard's cricket frog)	1983	S1	G5T5	END	
3	Animal	*Ardea alba* (Great egret)	1996	S1B,SZN	G5	THR	
3	Animal	*Chlosyne gorgone* (Gorgone checker spot)	1988	S3	G5	SC/N	
3	Animal	*Notropis texanus* (Weed shiner)	1927	S2S3	G5	SC/N	
3	Animal	*Nycticorax nycticorax* (Black-crowned night-heron)	2000	S2B,SZN	G5	SC/M	
3	Animal	*Opsopoeodus emiliae* (Pugnose minnow)		S3	G5	SC/N	
3	Animal	*Sterna forsteri* (Forster's tern)	1986	S2B,SZN	G5	END	
3	Animal	*Vertigo tridentata* (Honey vertigo)	1997	S3	G4G5	SC/N	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Community	Emergent aquatic	1978	S4	G4	NA	
3	Community	Southern mesic forest	1988	S3	G3?	NA	

CLASS	GROUP	SCIENTIFIC NAME (COMMON NAME)	DATE	SRANK	GRANK	WI-STATUS	USESA STATUS
3	Other	Bird rookery	1996	SU		SC	

* See Appendix 3 for an explanation of NHI status' and rankings

THREATS AND MANAGEMENT CONSIDERATIONS

The purpose of this section is to summarize the threats that were identified during the inventory and by reviewing other reports. Management considerations related to conserving the Escarpment's biodiversity are also provided.

CURRENT THREATS

Land use issues, conflicts, problems. An analysis done by the Bay-Lake Regional Planning Commission in 2001 compared land use controls and discussed how each affects protection of the resources in the Niagara Escarpment study area. Several problems and conflicts between land use plans and existing regulations were noted. Land use comprehensive plans developed by various units of government were often not consistent with local zoning. For example, county plans were not consistent with town plans, and areas were classified differently under their respective plans and did not cross civic borders. Most of the existing plans do not recognize the Escarpment as a unique natural feature.

Development. One of the most pressing threats to the Niagara Escarpment is residential development. As the population of Wisconsin increases, cities and villages in the study area continue to grow. The natural beauty of the Door Peninsula draws many tourists year-round, and there has been a rise in second-home development. There is increasing pressure to construct piers and areas for boat launches on the adjoining Lake Michigan shoreline. In areas where there has been limited development in the past, the construction of homes and associated infrastucture fragments the sensitive habitats and may destroy habitat for rare plants and animals.

Road construction. As the year-round population and popularity of the study area as a recreational destination increase, highway construction and expansion will intensify. Higher capacity roads will likely increase development along the Escarpment by providing easier and faster access between the Door Peninsula and Green Bay. Hydrologic disruption and outright destruction of some of the Escarpment features may occur due to road construction or upgrading.

Mining, quarrying. Due to the relatively thin layer of soil and the relative ease in accessing bedrock, quarries of varying sizes have been and continue to be developed at several locations along the Niagara Escarpment. Quarrying is tied to development as various resources are extracted for construction materials. The Escarpment is used as a resource for the gravel and crushed stone used in construction of roads and residences, and for flagstone for home business development. Quarrying can have several impacts including the obvious direct habitat destruction and fragmentation. A less obvious effect of mining can be the alteration the hydrology and microclimate of the Escarpment.

Tower areas. Because of the topography and location of the Niagara Escarpment, utility companies have become interested in using it as a wind generator location. The construction of cellular, television, and radio towers has increased dramatically in recent years and this trend will likely continue or increase. Towers may have detrimental impacts on bird populations, and result in a loss in scenic beauty in the area.

Recreation. As the Escarpment has increased in popularity, the demand for recreational opportunities has also increased. Increased visitation to popular public lands in the study area can result in overuse of designated trails and the development of unauthorized casual use trails. Additionally, trails can serve as conduits for the introduction of invasive species. Designing trails that lead to and from the Escarpment rather than along it would diminish some of the associated overuse problems. Re-routing certain existing trails could also limit excessive disturbance. As mentioned above, recreational demands will likely result in the construction of new piers, boat landings, parking areas, and access roads.

Invasive/exotic species. As natural habitats become more fragmented and disrupted and as visitor use increases, invasive species can be accidentally or deliberately introduced into high quality habitat. Uplands and wetlands may be vulnerable to aggressive invasive species like exotic buckthorns (*Rhamnus* spp.) and honeysuckles (*Lonicera* spp.), garlic mustard (*Allaria petiolaris*), purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and non-native strains of common reed (*Phragmites australis*). "Escaped" garden plants have also created local infestations that need to be carefully monitored, and removed as possible. Surface waters are not exempt either as aquatic plants like Eurasian water milfoil or animals like sea lampreys, spiny water fleas, zebra mussels, and carp can invade them (Corbisier et al., 2000). Invasive species can displace or eliminate native species, particularly rare species that have specific habitat requirements. Invasive species can substantially alter the structure and functioning of high quality natural communities. Abundant native species can also have negative ecological impacts, with excessive browse pressure from white-tailed deer in some Door County parks being the most notable example.

The largest plants of *Taxus canadensis* were on dolomite rock, out of the reach of deer. Photo taken in Newport State Park by Gary Fewless.

Hydrologic disruption. Springs, sinkholes, caves, and other karst features provide unique habitats for a vast array of rare species and natural communities, many of which are susceptible to hydrologic disruptions. For example, new construction can directly or indirectly affect groundwater infiltration rates and consequently change the amount of water that discharges from a spring. The other threats listed above can, directly or indirectly, alter the hydrologic cycle and thereby change the conditions necessary for the continued health of rare species populations and some natural communities.

Communities, especially wetlands, in the study area that are not on karst may also be subject to hydrologic disruptions. Wetlands ecosystems are important for many reasons, functionally (groundwater recharge areas, buffers, and water retention areas) and biologically (habitat for rare species, spawning areas for fish, prime nesting sites for birds). Hydrologic disruptions such as

draining or isolation alter the functioning of wetlands and reduce or eliminate important habitat for many species.

Groundwater contamination. Groundwater is an important source of potable water, and groundwater contamination has been a significant issue along the Escarpment for some years (Valvassori 1990). In areas of karst in the study area, pathways develop for water movement through the rock leading directly to the groundwater with little or no filtration. Surface activities such as agriculture (both crops and grazing), road salting, and non-point source pollution can contaminate water moving directly into the groundwater. The thin soils in the area can create other difficulties including the adverse effects of leaking underground storage tanks or deteriorating septic tanks.

Administrative inconsistency. The Escarpment is a natural feature of regional significance that crosses jurisdictional boundaries of local, county, state, and federal governments. The maze of overlapping, and sometimes conflicting, land use regulations and guidelines contributes to the difficulty in making progress toward effective conservation partnerships and actions.

MANAGEMENT CONSIDERATIONS

This section describes actions that will contribute to conservation of the Niagara Escarpment's biodiversity. They are grouped into 3 broad categories: monitoring and management, protection and planning, and communication and landowner education, and inventory needs.

MONITORING AND MANAGEMENT

Once high quality natural communities, rare species, and special features have been identified, it becomes important to attempt to perpetuate those features. The following are basic approaches that land managers can use to maintain important occurrences.

Monitoring. Monitoring changes is an important tool in determining the long-term health of and changes to natural communities and sensitive species populations. A long-term monitoring program is needed for populations of selected listed species, high quality natural communities, and state natural areas. Benchmark data can be collected at these locations to monitor changes over time. The comparison of results of monitoring over time with benchmarks can suggest appropriate management strategies.

Removal of invasive species. As mentioned above, invasive species can disrupt natural communities and displace rare species. Sites throughout the study area are threatened by invasive species. Routine identification and removal of invasive species, particularly those that are the most aggressive, is an urgent need. Prevention and rapid identification are key elements in minimizing the spread of invasive species.

Trail construction/expansion. Trails directly impact sensitive areas and can provide conditions for the establishment of invasive plants and corridors for their further spread. Invasive species may inadvertently be introduced on trails not only by visitors but also by trail maintenance

workers. Land managers should be aware of the potential ecological impacts of trail widening and construction.

PROTECTION AND PLANNING

To help maintain important element occurrences in the study area for the long-term, it may be necessary to look beyond individual properties and coordinate efforts among a diverse group of stakeholders. The following can provide some guidance in that direction.

Protection Efforts. A number of the inventoried sites are large contiguous tracts, some of which are adjacent to designated natural areas. Important properties should be linked together by some type of protection mechanism. Some mechanisms that should be considered are outright purchase, conservation easements, or dedication as State Natural Areas. A master list of priority sites in the study area should be developed and subsequent protection efforts should focus on these areas.

Planning. The BLRPC (2001) reports that some towns have not adopted zoning ordinances, and there isn't consistency in zoning from county to county much less town to town within the same county. As identified in the Bay-Lake Regional Planning Commission (2001) report, many of the existing land use plans and zoning ordinances along the Niagara Escarpment do not consider the unique ecological functions and attributes of the study area and are not therefore not compatible or consistent with the existing ecological features. For instance, in farmland preservation plans, the Escarpment is not recognized as an ecologically important area with the exception of those areas inside a park (classified as an "excluded area"). An attempt to integrate planning between local, state, and federal agencies should be a priority. Detailed planning recommendations can be found in the Bay-Lake Regional Planning Commission report.

COMMUNICATION AND LANDOWNER EDUCATION

While it is very important to obtain high quality information about elements of biodiversity in the study area, it is equally important to communicate the results to land managers and landowners.

Communication. It is hoped that the inventory results will be shared and discussed by landowners, land managers, agency personnel, local conservation groups, and other decision-makers. Visitors to public lands in the study area should be made aware of the geology and ecology of the many special features. Staff managing areas of special ecological significance and sensitivity on state, county, or local public lands will have special use for this information. A dialogue between managers and Natural Heritage Inventory Staff should continue to be an important outcome of this study. Researchers in Michigan and eastern Canada involved in Escarpment issues will continue to be important information sources.

Landowner stewardship. An attempt should be made to work with private landowners to inform them of the ecological significance of their properties and how to effectively manage them. Alternatives, such as conservation easements or tax law incentives, should be presented to landowners to enroll their land in some sort protection status.

INVENTORY AND RESEARCH NEEDS

While the inventory of the study area examined many sites and many elements, there is need to conduct additional work.

Additional aquatic surveys. Additional aquatic sites and habitats should be sampled in the study area to further understanding of the ecology and distribution of rare species and natural communities.

Bat roosts and hibernacula. Conservation significance of many Escarpment sites is inadequately documented and understood.

Vegetation sampling. More detailed characterization of Escarpment-associated bedrock communities is needed to better understand the structure, composition, and function of the vegetation. In addition to vascular plants, lichens and mosses will be important groups to study.

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APPENDIX 1. GLOSSARY OF TERMS USED IN THIS REPORT

Algific - cold-producing, referencing certain geological structures in calcareous rock that produce very cool, humid microclimates, unusual for the latitudes they are occurring in. Rare species, some thought to be Ice Age relics, have been documented in association with these habitats.

Alvar - a rare community that consists of areas of thin discontinuous soil overlying horizontal beds of limestone or dolomite found along Great Lakes shorelines. Relatively low tree cover and a distinctive biota that includes elements of rock pavement, prairie, savanna and boreal forest communities characterize them. Among these are regional endemics, some very rare.

aquatic macrophyte - vascular plants with special adaptations to aquatic habitats (lakes, streams, springs).

BER - Bureau of Endangered Resources of WDNR

complex - used here to reference an integrated mosaic of natural communities and/or aquatic features.

cuesta - a ridge composed of gently tipped rock strata with a long, gradual slope on one side and a relative steep scarp or cliff on the other.

diversity - used in this report as a shortened form for biological diversity, or biodiversity. A general definition (Addis et al., 1995) is "the spectrum of life forms and the ecological processes that support and sustain them. Biological diversity is a complex of four interacting levels: genetic, species, community, and ecosystem."

dolomite - a sedimentary, often bedded rock similar to limestone but differing due to the addition of magnesium ions.

ecological landscape - a classification that describes geographic areas according to specific geology, climate, topography, plant communities, soil types, natural processes, and other ecological factors.

ecoregion - geographic units that are differentiated by climate, subsurface geology, physiography, hydrology, soils, and vegetation. These units have been defined and organized in different ways by various agencies and institutions but in this document we use the National Hierarchical Framework of Ecological Units (NHFEU). As described by Avers et al (1994), the NHFEU can provide a basis for assessing resource conditions at multiple scales.

element - the basic building blocks of the Natural Heritage Inventory. They include natural communities, rare plants, rare animals, and other selected features such as colonial bird rookeries, bat hibernacula, and mussel beds. In short, an element is any biological or ecological entity upon which we wish to gather information for conservation purposes.

element occurrence - an individual example of an element (a natural community, a rare plant population, a rare animal population, or other feature tracked by the Natural Heritage Inventory program) at a specific geographic location.

exuviae - the cast (shed) exoskeleton of an invertebrate. –OR—The sloughed-off skin or covering of an animal, especially an arthropod.

fen - wetlands that receive nutrients via direct contact with mineral enriched groundwater. A "poor" fen has very low concentrations of plant nutrients and floristically resembles a bog. A "rich" fen has relatively high concentrations of nutrients, but is still characterized by the accumulation of peat (though this is likely to be primarily from the remains of plants other than sphagnum mosses, such as sedges and brown mosses).

fragmentation - the breaking up of large and continuous ecosystems, communities, and habitats into smaller discontinuous areas that are surrounded by altered or disturbed lands or aquatic features.

habitat - references those environmental attributes necessary to provide a niche that supports the needs of a species or group of species.

karst - terrain with distinctive characteristics of relief and drainage resulting from the dissolution of soluble rocks such as limestone and dolomite.

macroinvertebrate - Used in the report to refer to aquatic insects and mollusks.

matrix - used in this document to refer to the dominant land cover within which other features of the landscape are embedded.

monitoring - the repeated censusing of a species, suite of species, natural community or other feature of interest.

moraine - landforms composed of unsorted materials deposited by glaciers. They can cover broad geographic areas of millions of acres. Topography can vary from nearly level “till” plains to rough end moraine landscapes composed of steep dry ridges interspersed with deep kettle holes. These glacial “kettles” are frequent locations for lakes and wetlands.

National Hierarchical Framework of Ecological Units (NHFEU) - a land unit classification system developed by the U.S. Forest Service and many collaborators. As described by Avers et al (1994): “The NHFEU can provide a basis for assessing resource conditions at multiple scales. Broadly defined ecological units can be used for general planning assessments of resource capability. Intermediate scale units can be used to identify areas with similar disturbance regimes. Narrowly defined land units can be used to assess specific site conditions including: distributions of terrestrial and aquatic biota; forest growth, succession, and health; and various physical conditions.”

natural community - an assemblage of plants and animals, in a particular place at a particular time, interacting with one another, the abiotic environment around them, and subject to primarily natural disturbance regimes. Those assemblages that are repeated across a landscape in an observable pattern constitute a community type. No two assemblages, however, are exactly alike.

Natural Heritage Inventory - a methodology developed by the Science Division of The Nature Conservancy for collection, management, and use of biological, ecological, and related information. In Wisconsin, the Natural Heritage Inventory was established by an act of the state legislature in 1985, after which the program was installed within the WDNR’s Bureau of Endangered Resources.

northern hardwoods - generally applied to those forests of northern Wisconsin composed primarily of hardwoods such as sugar maple, basswood, ash, and birch. It is also sometimes used to refer to forests with a significant component of red maple or red oak, or sometimes even aspen, but

which lack strong representation by coniferous species. The term is also in wide usage in Michigan, northern Minnesota, and other locations that have vegetation similar to that of northern Wisconsin.

outwash - composed of materials sorted and deposited by glacial meltwaters. The resulting topography can be a level plain ("uncollapsed") or very hilly ("collapsed" or "pitted"). Pitted outwash may contain numerous lakes, which originated when blocks of ice stranded by a receding glacier were buried within outwash deposits. As the ice melted, depressions were created that filled with water. This is the most extensive landform found on the NH-AL SF.

peat - organic deposits consisting of the partially decomposed remains of plants, which accumulate over time more rapidly than decomposition processes can break them down. Peat may be derived from the remains of mosses, sedges, or woody plants.

Pleistocene - in the geologists parlance, "the first epoch of the Quaternary Period." In more common usage, the Ice Age. The topography, soils, and drainage patterns of the Escarpment landscape were strongly influenced by glaciation, which last occurred in this area approximately 12,000 years ago.

Rare - used in this report to refer to native species and natural communities known or suspected to be rare and/or declining in the state (included on NHI's "Working List"). Included are species legally designated as "Endangered" or "Threatened" by either the State of Wisconsin or the federal government, as well as species in the Department's advisory "Special Concern" category and on the U.S. Fish & Wildlife Service's "Candidate" and "Species of Concern" lists.

restoration - used in this report to refer to the re-establishment of a natural community, habitat, species population, or other ecological attribute, that has been eliminated or greatly reduced on a given location. Many factors, sociological as well as ecological, must be weighed when making a decision to engage in a restoration project.

State Natural Area - sites formally designated by the WDNR that contain outstanding examples of native biotic communities and are often the last refuges in the state for rare and endangered species of pants and animals. Areas are devoted to scientific research, the teaching of conservation biology, and especially to the preservation of their natural values and genetic diversity for future generations. The Department of Natural Resources currently administers 335 State Natural Areas encompassing more than 123,000 acres of land and water.

survey site - the geographic location at which a biological survey or evaluation has been conducted. Survey sites may be large or small, depending on the nature of the species or community surveyed and other factors. The boundaries of a survey site may be finite and discrete (a property boundary, the margins of a single stand of a natural community, or even the limits of a rare plant population) or rather arbitrary. When sites become very large (exceeding several thousand acres) and encompass complex landscapes they may be referenced as "macrosites."

Tension zone – the northern and southern portions of the basin are roughly divided by the tension zone, a narrow region extending from northwest to southeast across Wisconsin, approximating an s-shape (Fig. 2). The tension zone separates the mixed conifer-hardwood forests of the north from the prairie/savanna/hardwood forests of the south. Many native plant and animal species occupy ranges roughly delineated by the tension zone.

TNC - The Nature Conservancy, a private conservation organization responsible for developing the standardized methodology used by Natural Heritage programs.

WDNR - Wisconsin Department of Natural Resources

APPENDIX 2. OVERVIEW OF NHI METHODOLOGY

Natural Heritage Inventory Overview and General Methodology

The Wisconsin Natural Heritage Inventory program is part of an international network of NHI programs. The defining characteristic of this network, and the feature that unites the programs, is the use of a standard methodology for collecting, processing, and managing data on the occurrences of natural biological diversity. This network of data centers was established by The Nature Conservancy and is currently coordinated by NatureServe, an international non-profit organization.

Natural Heritage Inventory programs focus on rare species, natural communities, and other rare elements of nature. When NHI programs are established, one of the first tasks facing the staff is to consolidate existing information on the status and location of rare elements. Before proceeding, the NHI program must determine what elements warrant "tracking" and which are more common. Similar to most states, Wisconsin biologists had a general idea of which species in the better-studied taxonomic groups (e.g., mammals, birds, and vascular plants) were rare or declining. For less-studied groups such as macroinvertebrates, the process of assembling the list of species to track and gathering the data were quite dynamic. Initially, NHI staff cast a wide net, collecting data on many species from existing sources (e.g., scientific literature, field guides, books, maps, and museum collections) as well as from direct contact with experts throughout the state. As more data were gathered, it was clear that some species were more common than originally thought and the NHI program stopped collecting data on them. Thus, the list of which elements are tracked, the NHI Working List, changes over time as species' populations change (both up and down) and as our knowledge about their status and distribution increases. This evolution continues today, with the NHI Working List typically going through several revisions a year. The most current Wisconsin Natural Heritage Working List for the State of Wisconsin as of this writing (dated December, 2001) is available through the NHI office.

In general, there are two approaches to surveying biodiversity: (1) those focused on locating occurrences of particular elements, and (2) those focused on assessing the components of a particular area. The latter approach employs a "top down" analysis that begins with an assessment of the natural communities and aquatic features present, their relative quality and condition, the surrounding landscape pattern, and current land use and results in the identification of future species-oriented surveys. This approach, commonly referred to as “coarse filter-fine filter,” concentrates inventory efforts on those sites most likely to contain target species. It also allows sites to be placed in a larger, landscape context for more broad applications of ecosystem management principles.

NHI inventories typically use the top-down, coarse filter-fine filter approach. The initial analysis assesses the entire region and determines the important ecological attributes and the biological processes supporting them. Criteria to evaluate sites are established and then vegetative communities are identified and characterized. Based upon existing habitat characteristics and known habitat preferences of various rare species, sites where species-specific surveys were most appropriate are identified***. No doubt, occurrences of rare species exist that are not located through these inventories.*** However, by concentrating inventory efforts on the highest quality or

otherwise suitable sites, it is most likely that the populations with the highest conservation value are located.

The NHI methodology for organizing and storing data is actually a system of three inter-related data storage techniques: structured manual information files, topographic map files, and a computer database that integrates the various information. The computer component, known as the Biological & Conservation Data System (BCD), was developed by The Nature Conservancy for use by the Heritage Network. It is a sophisticated relational database management application built upon the Advanced Revelation application environment. Owing to the diversity and complexity of the information managed--from species taxonomy and ecosystem classification to real estate transactions--the system contains 36 database files and more than 2,000 information fields. The data in the Biological & Conservation Data System populate the NHI Geographic Information System.

INVENTORY METHODS

The following is a description of standard NHI methods for conducting NHI inventories. Any step may be modified, dropped, or repeated as appropriate to the project.

File Compilation: Involves obtaining existing records of natural communities, rare plants and animals, and aquatic features for the study area and surrounding lands and waters from the Biological & Conservation Data system, housed within DNR's Natural Heritage Inventory. Other databases with potentially useful information may also be queried, such as: forest stand/compartment reconnaissance, which is available for many public agency owned lands; the DNR Surface Water Resources series for summaries of the physical, chemical, and biological characteristics of lakes and streams (statewide, by county); the Milwaukee Public Museum's statewide Herp Atlas; museum/herbarium collections for various target taxa; soil surveys; and the fish distribution database (by watershed, WDNR-Research).

Additional data sources are sought out as warranted by the location and character of the site, and the purpose of the project. Manual files maintained within the Bureau of Endangered Resources contain information on a variety of subjects relevant to the inventory of natural features and are frequently useful.

Literature Review: Field biologists involved with a given project consult basic references on the natural history and ecology of the region within which the study area is situated. This can both broaden and sharpen the focus of the investigator.

Target Elements: Lists of target elements including natural communities, rare plants and animals, and aquatic features are developed for the study area. Field inventory is then scheduled for the times when these elements are most identifiable or active.

Map Compilation: USGS 7.5 minute topographic quadrangles serve as the base maps for field survey and often yield useful clues regarding access, extent of area to be surveyed, developments, and the presence and location of special features.

WDNR wetland maps consist of aerial photographs upon which all wetlands down to a scale of 2 or 5 acres have been delineated. Each wetland polygon is classified based on characteristics of vegetation, soils, and water depth.

Ecoregion maps are useful for comprehensive projects covering large geographic areas such as counties, national and state forests, and major watersheds. These maps integrate basic ecological information on climate, landforms, geology, soils, and vegetation. As these maps evolve, they should become increasingly useful, even for relatively small, localized projects.

Geographic Information Systems (GIS) are increasing our ability to integrate spatial information on lands and waters of the state and are becoming a basic resource tool for the efficient and comprehensive planning of surveys and the analysis of their results.

Aerial photographs: These provide information on a study area not available from maps, paper files, or computer printouts. Examination of both current and historical photos, taken over a period of decades, can be especially useful in revealing changes in the environment over time.

Original Land Survey Records: The surveyors who laid out the rectilinear Town-Range-Section grid across the state in the mid-nineteenth century recorded trees by species and size at all section corners and along section lines. These notes also record general impressions of vegetation, soil fertility, and topography, and note aquatic features, wetlands, and recent disturbances such as windthrow and fire. As these surveys typically occurred prior to extensive settlement of the state by Europeans, they constitute a valuable record of conditions prior to extensive modification of the landscape by European technologies and settlement patterns.

Interviews: Interviews with scientists, naturalists, land managers or others knowledgeable about the area to be surveyed often yield information not available in other formats.

Analysis of Compiled Information: The compiled information is analyzed to identify inventory priorities, determine needed expertise, and develop budgets.

Meetings: Planning and coordination meetings are held with all participants to provide an overview of the project, share information, identify special equipment needs, coordinate schedules, and assign landowner contact responsibilities. Team development may be a part of this step.

Aerial Reconnaissance: Fly-overs are desirable for large sites, and for small sites where contextual issues are especially important. When possible, this should be done both before and after ground level work. Flights are scheduled for those times when significant features of the study area are most easily identified and differentiated. They are also useful for observing the general lay of the land, vegetation patterns and patch sizes, aquatic features, infrastructure, and disturbances within and around the site.

APPENDIX 3. NHI WORKING LIST AND KEY

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked and we encourage data submissions on these species. This list is meant to be dynamic--it is updated as often as new information regarding the biological status of species becomes available. The Natural Heritage Program welcomes your input on any aspect of this list. Wisconsin's extirpated species list is at the end. Changes from the previous list (10/00) are bolded.

KEY

ELCODE: Unique 10 digit code for each element (plant, animal, or natural community).

Scientific Name: Scientific name used by the Wisconsin Natural Heritage Inventory Program.

Common Name: Standard, contrived, or agreed upon common names.

Global Rank: Global element rank. Refer to the Rank Definition Sheet.

State Rank: State element rank. Refer to the Rank Definition Sheet.

US Status: Federal protection status in Wisconsin, designated by the Office of Endangered Species, U.S. Fish and Wildlife Service through the U.S. Endangered Species Act. LE = listed endangered; LT = listed threatened; XN = non-essential experimental population(s); LT,PD = listed threatened, proposed for de-listing; C = candidate for future listing.

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern.

WDNR and federal regulations regarding Special Concern species range from full protection to no protection. The current categories and their respective level of protection are SC/P = fully protected; SC/N = no laws regulating use, possession, or harvesting; SC/H = take regulated by establishment of open closed seasons; SC/FL = federally protected as endangered or threatened, but not so designated by WDNR; SC/M = fully protected by federal and state laws under the Migratory Bird Act.

Special Concern species are those species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.

GLOBAL & STATE ELEMENT RANK DEFINITIONS
WISCONSIN NATURAL HERITAGE INVENTORY PROGRAM

GLOBAL ELEMENT RANKS:

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single state or physiographic region) or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.

G4 = Apparently globally secure, though it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GH = Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered.

GU = Possibly in peril range-wide, but their status is uncertain. More information is needed.

GX = Believed to be extinct throughout its range (e.g. Passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? = Not ranked.
Species with a questionable taxonomic assignment are given a "Q" after the global rank. Subspecies and varieties are given subranks composed of the letter "T" plus a number or letter. The definition of the second character of the subrank parallels that of the full global rank. (Examples: a rare subspecies of a rare species is ranked G1T1; a rare subspecies of a common species is ranked G5T1.)

STATE ELEMENT RANKS

S1 = Critically imperiled in Wisconsin because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.

S2 = Imperiled in Wisconsin because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.

S3 = Rare or uncommon in Wisconsin (21 to 100 occurrences).

S4 = Apparently secure in Wisconsin, with many occurrences.

S5 = Demonstrably secure in Wisconsin and essentially ineradicable under present conditions.

SA = Accidental (occurring only once or a few times) or casual (occurring more regularly although not every year); a few of these species (typically long-distance migrants such as some birds and butterflies) may have even bred on one or more of the occasions when they were recorded.

SE = An exotic established in the state; may be native elsewhere in North America.

SH = Of historical occurrence in Wisconsin, perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an element would become SH without such a 20-year delay if the only known occurrence were destroyed or if it had been extensively and unsuccessfully looked for.

SN = Regularly occurring, usually migratory and typically non-breeding species for which no significant or effective habitat conservation measures can be taken in Wisconsin. This category includes migratory birds and bats that pass through twice a year or, may remain in the winter (or, in a few cases, the summer) along with certain lepidoptera which regularly migrate to Wisconsin where they reproduce, but then completely die out every year with no return migration. Species in this category are so widely and unreliably distributed during migration or in winter that no small set of sites could be set aside with the hope of significantly furthering their conservation.

SZ = Not of significant conservation concern in Wisconsin, invariably because there are no definable occurrences in the state, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long-distance migrants whose occurrence during their migrations are too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped, and protected. Typically, the SZ rank applies to a non-breeding population.

SR = Reported from Wisconsin, but without persuasive documentation which would provide a basis for either accepting or rejecting the report. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports that are hard to dismiss because the habitat is now destroyed.

SRF = Reported falsely (in error) from Wisconsin but this error is persisting in the literature.

SU = Possibly in peril in the state, but their status is uncertain. More information is needed.

SX = Apparently extirpated from the state.

STATE RANKING OF LONG-DISTANCE MIGRANT ANIMALS:

Ranking long distance aerial migrant animals presents special problems relating to the fact that their non-breeding status (rank) may be quite different from their breeding status, if any, in Wisconsin. In other words, the conservation needs of these taxa may vary between seasons. In order to present a less ambiguous picture of a migrant's status, it is necessary to specify whether the rank refers to the breeding (B) or non-breeding (N) status of the taxon in question. (e.g. S2B,S5N).

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
RARE MAMMALS					
Alces alces	moose	G5	S1		SC/P
Canis lupus	timber wolf	G4	S2	LE	THR
Puma concolor schorgeri	Wisconsin Puma	G5T3Q	SH		SC/P
Lepus townsendii	white-tailed jackrabbit	G5	S1S2		SC/H
Martes americana	American marten	G5	S3		END
Microtus ochrogaster	prairie vole	G5	S2		SC/N
Microtus pinetorum	woodland vole	G5	S1		SC/N
Myotis septentrionalis	northern myotis	G4	S4		SC/N
Myotis sodalis	Indiana bat	G2	SA	LE	SC/FL
Napaeozapus insignis	woodland jumping mouse	G5	S2S3		SC/N
Pipistrellus subflavus	eastern pipistrelle	G5	S3S4		SC/N
Reithrodontomys megalotis	western harvest mouse	G5	S2		SC/N
Sorex arcticus	arctic shrew	G5	S2		SC/N
Sorex hoyi	pigmy shrew	G5	S3		SC/N
Sorex palustris	water shrew	G5	S2		SC/N
Spermophilus franklinii	Franklin's ground squirrel	G5	S2S3		SC/N
Spilogale putorius	spotted skunk	G5	SH		SC/N
RARE BIRDS					
Accipiter gentilis	Northern Goshawk	G5	S2N,S2B		SC/M
Aechmophorus occidentalis	Western Grebe	G5	SAB,SZN		SC/M
Ammodramus henslowii	Henslow's Sparrow	G4	S2S3B,SZN		THR
Ammodramus leconteii	Le Conte's Sparrow	G4	S2B,SZN		SC/M
Ammodramus nelsoni	Sharp-tailed Sparrow	G5	S1B,SZN		SC/M
Ammodramus savannarum	Grasshopper Sparrow	G5	S3B,SZN		SC/M
Anas acuta	Northern Pintail	G5	S3B,SZN		SC/M
Anas americana	American Wigeon	G5	SUB,SZN		SC/M
Anas rubripes	American Black duck	G5	S2N,S3B		SC/M
Ardea alba	Great Egret	G5	S1B,SZN		THR
Ardea herodias	Great Blue heron	G5	S3B,SAN		SC/M
Asio flammeus	Short-eared Owl	G5	S1B,SZN		SC/M
Asio otus	Long-eared Owl	G5	S2S3B,SZN		SC/M
Aythya affinis	Lesser Scaup	G5	S1B,SZN		SC/M
Aythya americana	Redhead	G5	S2B,SZN		SC/M
Aythya valisineria	Canvasback	G5	S2S3B,S?N		SC/M
Bartramia longicauda	Upland Sandpiper	G5	S2B,SZN		SC/M
Botaurus lentiginosus	American Bittern	G4	S3B,SZN		SC/M
Bubulcus ibis	Cattle Egret	G5	S1B,SZN		SC/M
Bucephala clangula	Common Goldeneye	G5	S2B,SZN		SC/M
Buteo lineatus	Red-shouldered Hawk	G5	S1N,S3S4B		THR
Carduelis pinus	Pine Siskin	G5	S1B,SZN		SC/M
Catharus ustulatus	Swainson's Thrush	G5	S2B,SZN		SC/M
Charadrius melodus	Piping Plover	G3	S1	LE	END
Chlidonias niger	Black Tern	G4	S3B,SZN		SC/M
Chondestes grammacus	Lark Sparrow	G5	S2B,SZN		SC/M
Circus cyaneus	Northern Harrier	G5	S2N,S3B		SC/M
Coccothraustes vespertinus	Evening Grosbeak	G5	S2B,SZN		SC/M
Coccyzus americanus	Yellow-billed Cuckoo	G5	S3B,SZN		SC/M
Coturnicops noveboracensis	Yellow Rail	G4	S1B,SZN		THR
Cygnus buccinator	Trumpeter Swan	G4	S1B,SZN		END
Dendroica caerulescens	Black-throated Blue Warbler	G5	S3B,SZN		SC/M
Dendroica cerulea	Cerulean Warbler	G4	S2S3B,SZN		THR
Dendroica dominica	Yellow-throated Warbler	G5	S1B,SZN		END
Dendroica kirtlandii	Kirtland's Warbler	G1	SAN	LE	SC/M
Dendroica tigrina	Cape May Warbler	G5	S3B,SZN		SC/M
Egretta thula	Snowy Egret	G5	S1B,SZN		END
Empidonax flaviventris	Yellow-bellied Flycatcher	G5	S2B,SZN		SC/M

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
Empidonax virescens	Acadian Flycatcher	G5	S2S3B,SZN		THR
Falcipennis canadensis	Spruce Grouse	G5	S1S2B,S1S2N		THR
Falco columbarius	Merlin	G5	S3B,S2N		SC/M
Falco peregrinus	Peregrine Falcon	G4	S1B,S1N		END
Gallinula chloropus	Common Moorhen	G5	S3B,SZN		SC/M
Gavia immer	Common Loon	G5	S3S4B,SZN		SC/M
Haliaeetus leucocephalus	Bald Eagle	G4	S2N,S3B	LT,PD	SC/FL
Helmitheros vermivorus	Worm-eating Warbler	G5	S1B,SZN		END
Icteria virens	Yellow-breasted Chat	G5	S1B,SZN		SC/M
Icterus spurius	Orchard Oriole	G5	S3B,SZN		SC/M
Ixobrychus exilis	Least Bittern	G5	S3B,SZN		SC/M
Lanius ludovicianus	Loggerhead Shrike	**G4**	S1B,SZN		END
Larus marinus	Great Black-backed Gull	G5	SAB,SZN		SC/M
Larus minutus	Little Gull	G5	S1?B,SZN		SC/M
Larus philadelphia	Bonaparte's Gull	G5	SAB,SZN		SC/M
Melanerpes erythrocephalus	Red-headed Woodpecker	G5	S3B,SZN		SC/M
Mergus merganser	Common Merganser	G5	S3B,SZN		SC/M
Mergus serrator	Red-breasted Merganser	G5	S3B,SZN		SC/M
Nyctanassa violacea	Yellow-crowned Night-heron	G5	S1B,SZN		THR
Nycticorax nycticorax	Black-crowned Night-heron	G5	S2B,SZN		SC/M
Oporornis agilis	Connecticut Warbler	G4	S3B,SZN		SC/M
Oporornis formosus	Kentucky Warbler	G5	S2B,SZN		THR
Pandion haliaetus	Osprey	G5	S3S4B,SZN		THR
Pelecanus erythrorhynchos	American White pelican	G3	S1B,S1N		SC/M
Perisoreus canadensis	Gray Jay	G5	S3B,SZN		SC/M
Phalaropus tricolor	Wilson's Phalarope	G5	S2B,SZN		SC/M
Picoides arcticus	Black-backed Woodpecker	G5	S2B,SZN		SC/M
Podiceps grisegena	Red-necked Grebe	G5	S1B,SZN		END
Poecile hudsonica	Boreal Chickadee	G5	S3B,SZN		SC/M
Protonotaria citrea	Prothonotary Warbler	G5	S3B,SZN		SC/M
Rallus elegans	King Rail	G4G5	S2B,SZN		SC/M
Seiurus motacilla	Louisiana waterthrush	G5	S3B,SZN		SC/M
Spiza americana	Dickcissel	G5	S3B,SZN		SC/M
Sterna caspia	Caspian Tern	G5	S1B,S2N		END
Sterna forsteri	Forster's Tern	G5	S2B,SZN		END
Sterna hirundo	Common Tern	G5	S1B,S2N		END
Strix nebulosa	Great Gray Owl	G5	S1B,SZN		SC/M
Sturnella neglecta	Western Meadowlark	G5	S3S4B,SZN		SC/M
Tympanuchus cupido	Greater Prairie-chicken	G4	S2B,S2N		THR
Tympanuchus phasianellus	Sharp-tailed Grouse	G4	S2B,S2N		SC/M
Tyto alba	Barn Owl	G5	S1B,S1N		END
Vermivora peregrina	Tennessee Warbler	G5	S1B,SZN		SC/M
Vireo bellii	Bell's Vireo	G5	S2B,SZN		THR
Vireo griseus	White-eyed Vireo	G5	**SAB,SZN**		SC/M
Wilsonia citrina	Hooded Warbler	G5	S2B,SZN		THR
RARE REPTILES AND AMPHIBIANS					
Acris crepitans blanchardi	Blanchard's cricket frog	G5T5	S1		END
Apalone mutica	midland smooth softshell turtle	G5	S3		SC/H
Carphophis amoenus	western worm snake	G5	S1?		SC/H
Clemmys insculpta	wood turtle	G4	S3		THR
Coluber constrictor	yellow-bellied racer	G5	S2S3		SC/P
Crotalus horridus	timber rattlesnake	G4	S2S3		SC/H
Diadophis punctatus arnyi	prairie ringneck snake	G5T5	SU		SC/H
Diadophis punctatus edwardsii	northern ringneck snake	G5T5	S3?		SC/H
Elaphe obsoleta	black rat snake	G5	S2S3		SC/P
Emydoidea blandingii	Blanding's turtle	G4	S3		THR
Graptemys pseudogeographica	**false map turtle**	**G5**	**S4**		**SC/H**

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
Hemidactylium scutatum	four-toed salamander	G5	S3		SC/H
Ophisaurus attenuatus	western slender glass lizard	G5	S2		END
Pituophis catenifer ***sayi***	bullsnake	**G5T5**	S3S4		SC/P
Rana catesbeiana	bullfrog	G5	S3		SC/H
Regina septemvittata	queen snake	G5	S1		END
Sistrurus catenatus catenatus	eastern massasauga rattlesnake	**G3G4T3T4**	S2	C	END
Terrapene ornata	ornate box turtle	G5	S2		END
Thamnophis butleri	Butler's garter snake	G4	S2		THR
Thamnophis proximus	western ribbon snake	G5	S1?		END
Thamnophis sauritus	northern ribbon snake	G5	S1?		END
RARE FISH					
Acipenser fulvescens	lake sturgeon	**G3G4**	S3		SC/H
Alosa chrysochloris	skipjack herring	G5	S1		END
Anguilla rostrata	American eel	G5	S1S2		SC/N
Aphredoderus sayanus	pirate perch	G5	S2S3		SC/N
Clinostomus elongatus	redside dace	G4	S3		SC/N
Coregonus artedi	lake herring	G5	S3		SC/N
Coregonus hoyi	bloater	G4	S3?		SC/H
Coregonus kiyi	kiyi	G3	S2S3		SC/H
Coregonus reighardi	**shortnose cisco**	**G1**	**SH**		**SC/H**
Coregonus zenithicus	shortjaw cisco	**G3**	S2S3		SC/H
Crystallaria asprella	crystal darter	G3	S1		END
Cycleptus elongatus	blue sucker	**G3G4**	S3		THR
Erimystax x-punctatus	gravel chub	G4	S1S2		END
Erimyzon sucetta	lake chubsucker	G5	S3		SC/N
Etheostoma asprigene	mud darter	G4G5	S2S3		SC/N
Etheostoma chlorosoma	bluntnose darter	G5	S1		END
Etheostoma clarum	western sand darter	G3	S3		SC/N
Etheostoma microperca	least darter	G5	S3		SC/N
Fundulus diaphanus	banded killifish	G5	S3		SC/N
Fundulus dispar	starhead topminnow	G4	S2		END
Hiodon alosoides	goldeye	G5	S2		END
Ictiobus niger	black buffalo	G5	S2?		THR
Lepomis megalotis	longear sunfish	G5	S2		THR
Luxilus chrysocephalus	striped shiner	G5	S1		END
Lythrurus umbratilis	redfin shiner	G5	S3		THR
Macrhybopsis aestivalis	**shoal chub**	G5	S2S3		THR
Macrhybopsis storeriana	silver chub	G5	SU		SC/N
Moxostoma carinatum	river redhorse	G4	S2S3		THR
Moxostoma duquesnei	black redhorse	G5	S1		END
Moxostoma valenciennesi	greater redhorse	**G4**	S2S3		THR
Notropis amnis	pallid shiner	G4	S2		END
Notropis anogenus	pugnose shiner	G3	S2S3		THR
Notropis nubilus	Ozark minnow	G5	S2		THR
Notropis texanus	weed shiner	G5	S2S3		SC/N
Noturus exilis	slender madtom	G5	S2		END
Opsopoeodus emiliae	pugnose minnow	G5	S3		SC/N
Percina evides	gilt darter	G4	S2		THR
Polyodon spathula	paddlefish	G4	S2?		THR
Prosopium coulteri	pygmy whitefish	G5	S2		SC/N
RARE MUSSELS					
Alasmidonta marginata	elktoe	G4	S4		SC/H
Alasmidonta viridis	slippershell mussel	G4G5	S2		THR
Anodonta suborbiculata	flat floater	G5	S1S2		SC/H
Arcidens confragosus	rock pocketbook	G4	S1S2		THR
Cumberlandia monodonta	spectacle case	G2G3	S1		END
Cyclonaias tuberculata	purple wartyback	G5	S1		END

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
Ellipsaria lineolata	butterfly	G4	S2		END
Elliptio complanata	eastern elliptio	G5	S3		SC/H
Elliptio crassidens	elephant ear	G5	S1		END
Epioblasma triquetra	snuffbox	G3	S1		END
Fusconaia ebena	ebony shell	G4G5	S1		END
Lampsilis higginsii	Higgins' eye	G1	S1	LE	END
Lampsilis teres	**yellow & slough sandshells**	**G5**	S1		END
Megalonaias nervosa	washboard	G5	S3		SC/H
Pisidium cruciatum	ornamented peaclam	GU	SU		SC/H
Plethobasus cyphyus	bullhead	G3	S1		END
Pleurobema sintoxia	round pigtoe	G4	S3		SC/H
Pyganodon cataracta	eastern floater	G5	SU		SC/H
Quadrula fragosa	winged mapleleaf	G1	S1	LE	END
Quadrula metanevra	monkeyface	G4	S2		THR
Quadrula nodulata	wartyback	G4	S1S2		THR
Simpsonaias ambigua	salamander mussel	G3	S2S3		THR
Tritogonia verrucosa	buckhorn	G4	S2		THR
Venustaconcha ellipsiformis	ellipse	G3G4	S2		THR
Villosa iris	rainbow shell	G5	S1		END
RARE BUTTERFLIES AND MOTHS					
Acrocercops pnosmodiella	marbleseed leafminer	G?	SU		SC/N
Atrytonopsis hianna	dusted skipper	G4G5	S2?		SC/N
Boloria eunomia	bog fritillary	G5	S3		SC/N
Boloria freija	freija fritillary	G5	S2		SC/N
Boloria frigga	frigga fritillary	G5	S2		SC/N
Boloria titania	purple lesser fritillary	G5	SU		SC/N
Calephelis muticum	swamp metalmark	G3G4	S1		END
Callophrys gryneus	olive hairstreak	G5	S3		SC/N
Callophrys henrici	Henry's elfin	G5	S2		SC/N
Callophrys irus	frosted elfin	G3	S1		THR
Catocala abbreviatella	abbreviated underwing moth	G4	S3		SC/N
Catocala coelebs	old maid underwing moth	G4	SU		SC/N
Catocala semirelicta	semirelict underwing moth	G5	SU		SC/N
Catocala whitneyi	Whitney's underwing moth	G3G4	S3		SC/N
Chlosyne gorgone	gorgone checker spot	G5	S3		SC/N
Copablepharon longipenne	a noctuid moth	G?	S1?		SC/N
Erebia discoidalis	red-disked alpine	G5	S2S3		SC/N
Erynnis baptisiae	wild indigo dusky wing	G5	S2S3		SC/N
Erynnis lucilius	columbine dusky wing	G4	S2		SC/N
Erynnis martialis	mottled dusky wing	G3G4	S2		SC/N
Erynnis persius	Persius dusky wing	G5	S2		SC/N
Euchlaena milnei	a looper moth	G2G4	SU		SC/N
Euphyes bimacula	two-spotted skipper	G4	S2S3		SC/N
Euphyes dion	dion skipper	G4	S3		SC/N
Faronta rubripennis	pink-streak	G3G4	SU		SC/N
Grammia oithona	Oithona tiger moth	G4	S2		SC/N
Grammia phyllira	Phyllira tiger moth	G4	S2		SC/N
Hemileuca sp 3	Midwestern fen buckmoth	G3G4Q	S3S4		SC/N
Hesperia comma	Laurentian skipper	G5	S2		SC/N
Hesperia leonardus leonardus	Leonard's skipper	G4T4	S3		SC/N
Hesperia leonardus pawnee	Leonard's pawnee skipper	G4T4	S2		SC/N
Hesperia metea	cobweb skipper	G4G5	S2		SC/N
Hesperia ottoe	Ottoe skipper	G3G4	S2		SC/N
Lycaeides idas nabokovi	northern blue butterfly	G5TU	S1		END
Lycaeides melissa melissa	Melissa blue	G5T5	SU		SC/N
Lycaeides melissa samuelis	Karner blue butterfly	G5T2	S2S3	LE	SC/FL
Lycaena dione	great copper	G5	S2		SC/N
Lycaena dorcas	dorcas copper	G5	S2		SC/N

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
Lycaena epixanthe	bog copper	G4G5	S2S3		SC/N
Macrochilo bivittata	an owlet moth	G3G4	S3		SC/N
Meropleon ***ambifuscum***	Newman's brocade	**G3G4**	S3		SC/N
Oarisma powesheik	powesheik skipperling	G2	S1		END
Oeneis chryxus	brown arctic	G5	S2?		SC/N
Oeneis jutta	jutta arctic	G5	S3		SC/N
Papaipema beeriana	liatris borer moth	G3	SU		SC/N
Papaipema silphii	silphium borer moth	G3G4	S2S3		END
Phyciodes batesii	tawny crescent spot	G4	S3		SC/N
Phytometra erestinana	Ernestine's moth	G4	SU		SC/N
Pieris virginiensis	West Virginia white	G3G4	S2		SC/N
Plebejus saepiolus	greenish blue	G5	SU		SC/N
Poanes massasoit	mulberry wing	G4	S3		SC/N
Poanes viator	broad-winged skipper	G5	S3		SC/N
Pompeius verna	little glassy wing	G5	S1?		SC/N
Problema byssus	byssus skipper	G3G4	S1?		SC/N
Psectraglaea carnosa	pink sallow	G3	SU		SC/N
Richia sp 1	**a noctuid moth**	**G2G3**	**S?**		**SC/N**
Satyrium caryaevorum	hickory hairstreak	G4	S2		SC/N
Satyrodes eurydice fumosa	smokey eyed brown	G5T3T4	S2		SC/N
Schinia bina	bina flower moth	G4	S2S3		SC/N
Schinia indiana	phlox moth	GU	S2?		END
Speyeria idalia	regal fritillary	G3	S1		END
RARE DRAGONFLIES AND DAMSELFLIES					
Aeshna clepsydra	mottled darner	G4	S2		SC/N
Aeshna eremita	lake darner	G5	S3		SC/N
Aeshna mutata	spatterdock darner	G3G4	S1		THR
Aeshna subarctica	subarctic darner	G5	S1		SC/N
Aeshna tuberculifera	black-tipped darner	G4	S3		SC/N
Aeshna verticalis	green-striped darner	G5	S3		SC/N
Archilestes grandis	great spreadwing	G5	S2		SC/N
Argia plana	highland dancer	G5	S2		SC/N
Arigomphus submedianus	jade clubtail	G5	S1S2		SC/N
Arigomphus villosipes	unicorn clubtail	G5	S2		SC/N
Chromagrion conditum	aurora damselfly	G5	S3		SC/N
Coenagrion interrogatum	subarctic bluet	G5	S2		SC/N
Cordulegaster diastatops	delta-spotted spiketail	G5	S1S2		SC/N
Cordulegaster obliqua	arrowhead spiketail	G4	S3		SC/N
Enallagma anna	river bluet	G5	S2		SC/N
Enallagma basidens	double-striped bluet	G5	S2		SC/N
Enallagma traviatum	slender bluet	G5	S1S2		SC/N
Enallagma vernale	Gloyd's bluet	G4Q	S1		SC/N
Epiaeschna heros	swamp darner	G5	S2S3		SC/N
Gomphaeschna furcillata	harlequin darner	G5	S2		SC/N
Gomphurus externus	plains clubtail	G5	S2		SC/N
Gomphurus lineatifrons	splendid clubtail	G4	S3		SC/N
Gomphurus ventricosus	skillet clubtail	G3	S3		SC/N
Gomphus graslinellus	pronghorned clubtail	G5	S2		SC/N
Gomphus quadricolor	**rapids clubtail**	**G3G4**	**S4**		**SC/N**
Gomphus viridifrons	green-faced clubtail	G3	S3		SC/N
Hetaerina titia	dark rubyspot	G5	S1S2		SC/N
Ischnura hastata	citrine forktail	G5	S2		SC/N
Ischnura kellicotti	lilypad forktail	G5	S1		SC/N
Ischnura posita	fragile forktail	G5	S2S3		SC/N
Lestes eurinus	amber-winged spreadwing	G4	S3		SC/N
Lestes inaequalis	elegant spreadwing	G5	S2S3		SC/N
Lestes vigilax	swamp spreadwing	G5	S3		SC/N
Libellula cyanea	white-spangled skimmer	G5	S2		SC/N
Libellula incesta	slaty skimmer	G5	S2		SC/N

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Libellula semifasciata	painted skimmer	G5	SH		SC/N
Libellula vibrans	great blue skimmer	G5	SH		SC/N
Macromia taeniolata	royal river cruiser	G5	S1		SC/N
Nannothemis bella	elfin skimmer	G4	S3		SC/N
Nasiaeschna pentacantha	Cyrano darner	G5	S3		SC/N
Neurocordulia molesta	smoky shadowfly	G4	S2S3		SC/N
Neurocordulia yamaskanensis	Stygian shadowfly	G5	S3		SC/N
Ophiogomphus anomalus	extra-striped snaketail	G3	S1		END
Ophiogomphus carolus	riffle snaketail	G5	S3		SC/N
Ophiogomphus howei	pygmy snaketail	G3	S3		THR
Ophiogomphus sp 1 nr aspersus	**sand** snaketail	**G2**	S2		SC/N
Ophiogomphus susbehcha	Saint Croix snaketail	G1G2	S1		END
Somatochlora cingulata	lake emerald	G5	S1		SC/N
Somatochlora elongata	ski-tailed emerald	G5	S2S3		SC/N
Somatochlora ensigera	lemon-faced emerald	G4	S1		SC/N
Somatochlora forcipata	forcipate emerald	G5	S2S3		SC/N
Somatochlora franklini	delicate emerald	G5	S2S3		SC/N
Somatochlora hineana	Hine's emerald	G2G3	S1	LE	END
Somatochlora incurvata	warpaint emerald	G4	S2		END
Somatochlora kennedyi	Kennedy's emerald	G5	S3		SC/N
Somatochlora tenebrosa	clamp-tipped emerald	G5	S2		SC/N
Stylogomphus albistylus	least clubtail	G5	S3		SC/N
Stylurus amnicola	**riverine clubtail**	**G4**	**S3**		**SC/N**
Stylurus notatus	elusive clubtail	G3	S2S3		SC/N
Stylurus plagiatus	russet-tipped clubtail	G5	S2		SC/N
Stylurus scudderi	zebra clubtail	G4	S3		SC/N
Sympetrum danae	black meadowhawk	G5	S3		SC/N
Tramea carolina	violet-masked glider	G5	S1S2		SC/N
Williamsonia fletcheri	ebony bog haunter	G3G4	S3S4		SC/N
Williamsonia lintneri	ringed boghaunter	**G3**	S2S3		SC/N
MISCELLANEOUS RARE INVERTEBRATES					
CRUSTACEANS					
Crangonyx gracilis	a side-swimmer	G4	SU		SC/N
Crangonyx richmondensis	a side-swimmer	G?	SU		SC/N
Lynceus brachyurus	**holartic clam shrimp**	**G5**	**S1S3**		**SC/N**
Orconectes propinquus	northern clearwater crayfish	G5	SU		SC/N
Palaemonetes kadiakensis	**Mississippi grass shrimp**	**G4**	**S1S3**		**SC/N**
Procambarus acutus	**white river crayfish**	**G5**	**S3?**		**SC/N**
Procambarus gracilis	prairie crayfish	G5	S2?		SC/N
Stygobromus putealis	Wisconsin well amphipod	G2G3	S1S2		SC/N
BEETLES					
Agabetes acuductus	**a predaceous diving beetle**	**G?**	**S2S3**		**SC/N**
Agabus bicolor	**a predaceous diving beetle**	**G?**	**S3**		**SC/N**
Agabus canadensis	a predaceous diving beetle	G?	SU		SC/N
Agabus confinis	**a predaceous diving beetle**	**G?**	**SU**		**SC/N**
Agabus confusus	a predaceous diving beetle	G?	SU		SC/N
Agabus gagates	a predaceous diving beetle	G?	SU		SC/N
Agabus inscriptus	**a predaceous diving beetle**	**G?**	**S2S3**		**SC/N**
Agabus wasastjernae	**a predaceous diving beetle**	**G?**	**S2?**		**SC/N**
Celina hubbelli	**a predaceous diving beetle**	**G?**	**S2S3**		**SC/N**
Cicindela hirticollis rhodensis	beach-dune tiger beetle	G5T4	S2		SC/N
Cicindela lepida	little white tiger beetle	G4	S2S3		SC/N
Cicindela limbalis transversa	a tiger beetle	G5T5	S1		SC/N
Cicindela macra	a tiger beetle	G5	S2		SC/N
Cicindela patruela huberi	a tiger beetle	G3T2	S3		SC/N
Cicindela patruela patruela	a tiger beetle	G3T3	S2		SC/N

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Collops vicarius	**a melyrid beetle**	**G?**	**S1**		**SC/N**
Copelatus chevrolati	a predaceous diving beetle	G?	SU		SC/N
Copelatus glyphicus	**a predaceous diving beetle**	**G?**	**S3?**		**SC/N**
Crenitis digestus	**a water scavenging beetle**	**G?**	**SU**		**SC/N**
Cymbiodyta acuminata	**a water scavenger beetle**	**G?**	**S3**		**SC/N**
Cymbiodyta blanchardi	**a water scavenging beetle**	**G?**	**SU**		**SC/N**
Cymbiodyta chamberlaini	**a water scavenging beetle**	**G?**	**SU**		**SC/N**
Cymbiodyta minima	**a water scavenging beetle**	**G?**	**S3**		**SC/N**
Cymbiodyta semistriatus	**a water scavenging beetle**	**G?**	**SU**		**SC/N**
Dubiraphia bivittata	**a Dubiraphia riffle beetle**	**G?**	**S3**		**SC/N**
Dubiraphia robusta	robust Dubiraphian riffle beetle	G1G3	S1		SC/N
Dytiscus alaskanus	a predaceous diving beetle	G?	SU		SC/N
Enochrus consortus	**a water scavenging beetle**	**G?**	**S3**		**SC/N**
Enochrus perplexus	**a water scavenging beetle**	**G?**	**S2?**		**SC/N**
Enochrus sayi	**a water scavenging beetle**	**G?**	**S3**		**SC/N**
Graphoderus manitobensis	**a predaceous diving beetle**	**G?**	**S2S3**		**SC/N**
Gyrinus impressicollis	**a beetle**	**G?**	**S2?**		**SC/N**
Haliplus canadensis	**a crawling water beetle**	**G?**	**S2**		**SC/N**
Haliplus fasciatus	a crawling water beetle	G?	SU		SC/N
Haliplus leopardus	**water beetle**	**G?**	**S1S3**		**SC/N**
Haliplus pantherinus	**a crawling water beetle**	**G?**	**S2S3**		**SC/N**
Haliplus tortilipenis	a crawling water beetle	G?	SU		SC/N
Helocombus bifidus	**a water scavenging beetle**	**G?**	**S3**		**SC/N**
Helophorus orchymonti	**a water scavenging beetle**	**G?**	**SU**		**SC/N**
Hydrobius melaenum	**a water scavenging beetle**	**G?**	**SU**		**SC/N**
Hydrocanthus iricolor	a burrowing water beetle	G?	SU		SC/N
Hydrochara leechi	a water scavenger beetle	G?	SU		SC/N
Hydrochara spangleri	**a water scavenging beetle**	**G?**	**S3?**		**SC/N**
Hydrocolus persimilis	**a diving beetle**	**G?**			**SC/N**
Hydroporus badiellus	**a predaceous diving beetle**	**G?**	**S3?**		**SC/N**
Hydroporus dichrous	**a predaceous diving beetle**	**G?**	**SU**		**SC/N**
Hydroporus hybridus	a predaceous diving beetle	G?	SU		SC/N
Hydroporus pseudovilis	a predaceous diving beetle	G?	S1S2		SC/N
Hydroporus pulcher	**a predaceous diving beetle**	**G?**	**S1?**		**SC/N**
Hydroporus vittatus	**a predaceous diving beetle**	G?	S3		SC/N
Hydroporus wickhami	**a predaceous diving beetle**	**G?**	**SU**		**SC/N**
Hygrotus marklini	a predaceous diving beetle	G?	S1S2		SC/N
Hygrotus sylvanus	Sylvan Hygrotus diving beetle	G1	S1		SC/N
Ilybius discedens	**a predaceous diving beetle**	**G?**	**S3**		**SC/N**
Ilybius ignarus	**diving beetle**	**G?**	**S3**		**SC/N**
Ilybius incarinatus	**a predaceous diving beetle**	**G?**	**S3S4**		**SC/N**
Ilybius subaeneus	a predaceous diving beetle	G?	SU		SC/N
Laccobius agilis	**a water scavenging beetle**	**G?**	**S2S3**		**SC/N**
Laccobius reflexipennis	**a predaceous beetle**	G?	S1S2		SC/N
Laccobius truncatipennis	**a water scavenging beetle**	**G?**	**SU**		**SC/N**
Liodessus cantralli	Cantrall's bog beetle	G?	SU		SC/N
Liodessus flavicollis	**a predaceous diving beetle**	**G?**	**S3?**		**SC/N**
Lioporeus triangularis	a predaceous diving beetle	G?	SU		SC/N
Listronotus echinodori	a weevil	G?	SU		SC/N
Lixellus hubbardi	a weevil	G?	SU		SC/N
Longitarsus subrufus	a Chrysomelid beetle	G?	S3?		SC/N
Matus bicarinatus	a predaceous diving beetle	G?	S2S3		SC/N
Matus ovatus	a predaceous diving beetle	G?	SU		SC/N
Megacephala virginica	Virginia big-headed tiger beetle	G5	S1		SC/N
Microcylloepus pusillus	an Elmid beetle	G?	SU		SC/N
Neoscutopterus hornii	**a predaceous diving beetle**	**G?**	**S1S3**		**SC/N**
Nicrophorus americanus	American burying beetle	**G2G3**	SH	LE	END
Oreodytes scitulus	a predaceous diving beetle	G?	SU		SC/N
Platypsyllus castoris	beaver beetle	G?	SU		SC/N
Rhantus sericans	a predaceous diving beetle	G?	S2?		SC/N
Rhantus sinuatus	**a predaceous diving beetle**	**G?**	**S3**		**SC/N**

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Sperchopsis tessellatus	**a water scavenging beetle**	**G?**	**S2S3**		**SC/N**
Stenelmis antennalis	a riffle beetle	G?	SU		SC/N
Stenelmis bicarinata	**a riffle beetle**	**G?**	**S3**		**SC/N**
Stenelmis douglasensis	Douglas stenelmis riffle beetle	G1G3	SU		SC/N
Stenelmis fuscata	**a riffle beetle**	**G?**	**S2**		**SC/N**
Stenelmis knobeli	Knobel's riffle beetle	G1G3	S1		END
Tropisternus ellipticus	**a water scavenging beetle**	**G?**	**SU**		**SC/N**
Xyloryctes jamaicensis	**rhinoceros beetle**	**G?**	**S1?**		**SC/N**
MAYFLIES					
Acanthametropus pecatonica	Pecatonica River mayfly	**G2**	S1		END
Baetisca obesa	**a mayfly**	**G5**	**S2**		**SC/N**
Brachycercus nasutus	**a Caenid mayfly**	**G2Q**	**S?**		**SC/N**
Brachycercus prudens	**a Caenid mayfly**	**G4**	**S?**		**SC/N**
Brachycercus sp 1 nr nasutus	a Caenid mayfly	**GU**	SU		SC/N
Caenis youngi	a Caenid mayfly	**G4**	S2S3		SC/N
Centroptilum walshi	**a Baetid mayfly**	**G2Q**	**S?**		**SC/N**
Cercobrachys sp 1 nr serpentis	a Caenid mayfly	**GU**	SU		SC/N
Dolania americana	American sand burying mayfly	**G4**	S1		SC/N
Homoeoneuria ammophila	an Oligoneurid mayfly	**G3**	S1S2		SC/N
Litobrancha recurvata	an Ephemerid mayfly	**G5**	SU		SC/N
Macdunnoa persimplex	a Heptageniid mayfly	**G4**	S1?		SC/N
Metretopus borealis	a Metretopodid mayfly	**G5**	S1S2		SC/N
Paracloeodes minutus	a small minnow mayfly	**G5**	S1?		SC/N
Parameletus chelifer	a primitive minnow mayfly	**G5**	S1?		SC/N
Pentagenia vittigera	an Ephemerid mayfly	**G5**	S2?		SC/N
Plauditus cestus	**a small minnow mayfly**	**G5**	**S2**		**SC/N**
Pseudiron centralis	a Heptageniid mayfly	G5	S3		SC/N
Spinadis wallacei	**Wallace's deepwater mayfly**	**G2**	**S1**		**END**
LEAFHOPPERS AND TRUE BUGS					
Aflexia rubranura	red-tailed prairie leafhopper	G1G2	S2		END
Attenuipyga vanduzeei	a prairie leafhopper	G?	S1?		SC/N
Cenocorixa dakotensis	a water boatman	G?	SU		SC/N
Destria crocea	a leafhopper	G?	S1?		SC/N
Dorycara platyrhyncha	**a leafhopper**	**G?**	**S?**		**SC/N**
Hebrus buenoi	**a velvet waterbug**	**G4**	**S1?**		**SC/N**
Hebrus burmeisteri	**a velvet waterbug**	**G?**	**S2S3**		**SC/N**
Hesperocorixa semilucida	**a water boatman**	**G?**	**S3**		**SC/N**
Hydrometra martini	**a water measurer**	**G5**	**S3**		**SC/N**
Laevicephalus vannus	a leafhopper	G?	S1?		SC/N
Limotettix pseudosphagneticus	**a leafhopper**	**G?**	**S1?**		**SC/N**
Microvelia albonotata	a broad-shouldered water strider	G?	SU		SC/N
Microvelia fontinalis	a broad-shouldered water strider	G?	SU		SC/N
Neogerris hesione	a water strider	G?	SU		SC/N
Nepa apiculata	a water scorpion	G?	SU		SC/N
Nepa nigra	**a water scorpion**	**G?**	**S2**		**SC/N**
Paraphilaenus parallelus	**a spittle bug**	**G?**	**S1?**		**SC/N**
Pelocoris femorata	a creeping water bug	G?	S2S3		**SC/N**
Polyamia dilata	net-veined leafhopper	G?	S1		THR
Ranatra nigra	**a water scorpion**	**G?**	**S2**		**SC/N**
Slaterobius quadristriata	a seed bug	G?	SU		SC/N
Trepobates knighti	a water strider	G?	SU		SC/N
GRASSHOPPERS AND ALLIES					
Aeropedellus clavatus	club-horned grasshopper	**G5**	S2		SC/N
Arphia conspersa	speckled rangeland grasshopper	**G5**	S2		SC/N

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Dichromorpha viridis	short-winged grasshopper	**G5**	S2		SC/N
Eritettix simplex	velvet-striped grasshopper	**G5**	S2		SC/N
*Hesperotettix **speciosus***	a grasshopper	**G5**	S1S2		SC/N
Melanoplus flavidus	blue-legged grasshopper	**G4**	S1?		SC/N
Mermiria bivittata	Mermiria grasshopper	**G5**	S2		SC/N
Neoconocephalus lyristes	**bog conehead**	**G?**	**SU**		**SC/N**
Neoconocephalus robustus	**crepitating conehead**	**G?**	**S1?**		**SC/N**
Orchelimum delicatum	delicate meadow katydid	G?	S2?		SC/N
*Orphulella **pelidna***	spotted-winged grasshopper	**G5**	S1?		SC/N
Paratylotropidia brunneri	**an acridid grasshopper**	**G4G5**	**S1?**		**SC/N**
Pardalophora phoenicoptera	orange-winged grasshopper	**G5**	S2		SC/N
Phoetaliotes nebrascensis	large-headed grasshopper	**G5**	S2		SC/N
Psinidia fenestralis	sand locust	**G5**	S1S2		SC/N
Spharagemon marmorata	northern marbled locust	**G5**	S2S3		SC/N
*Stethophyma **lineatum***	striped sedge grasshopper	**G5**	S2		SC/N
Trachyrhachys kiowa	ash-brown grasshopper	**G5**	S2		SC/N
Trimerotropis huroniana	Lake Huron locust	G2G3	S1		END
Trimerotropis maritima	seaside grasshopper	**G5**	S2		SC/N
STONEFLIES					
Agnetina flavescens	a Perlid stonefly	G5	SU		SC/N
Attaneuria ruralis	a stonefly	G4	S1?		SC/N
Isogenoides frontalis	a Perlid stonefly	G5	SU		SC/N
Isogenoides olivaceus	a Perlid stonefly	G3	SU		SC/N
Isoperla bilineata	**a Perlid stonefly**	**G5**	**S2S3**		**SC/N**
Isoperla lata	a Perlid stonefly	G5	SU		SC/N
Isoperla marlynia	**a Perlid stonefly**	**G5**	**S3**		**SC/N**
Isoperla richardsoni	**a Perlid stonefly**	**G4**	**S3**		**SC/N**
Soyedina vallicularia	a stonefly	G5	S1		SC/N
Zealeuctra narfi	a rolled-winged winter stonefly	G4	S1		SC/N
CADDISFLIES					
Agapetus hessi	a Glossosomatid caddisfly	G?	SU		SC/N
Asynarchus rossi	a northern casemaker caddisfly	G?	SU		SC/N
Banksiola dossuaria	a caddisfly	G?	**SU**		SC/N
Brachycentrus lateralis	a Brachycentrid caddisfly	G?	SU		SC/N
Fabria inornata	a Phryganeid caddisfly	G?	SU		SC/N
Hagenella canadensis	a Phryganeid caddisfly	G?	SU		SC/N
Hydropsyche bidens	**a caddisfly**	**G?**	**S2**		**SC/N**
Hydroptila valhalla	a caddisfly	G?	SU		SC/N
Hydroptila virgata	a caddisfly	G?	SU		SC/N
Lepidostoma libum	a bizarre caddisfly	G?	S1?		SC/N
Lepidostoma vernale	a bizarre caddisfly	G?	SU		SC/N
Ochrotrichia riesi	**a purse casemaker caddisfly**	**G?**	**S1?**		**SC/N**
Oecetis nocturna	**a caddisfly**	**G?**	**S1S3**		**SC/N**
Oxyethira anabola	a caddisfly	G?	SU		SC/N
Triaenodes dipsius	a long-horned casemaker caddisfly	G?	SU		SC/N
Triaenodes nox	**a caddisfly**	**G?**	**S1S3**		**SC/N**
Wormaldia moesta	a caddisfly	G?	SU		SC/N
SPIDERS					
Paradamoetas fontana	**a jumping spider**	**G?**	**S?**		**SC/N**
Phidippus pius	**a jumping spider**	**G?**	**S?**		**SC/N**
TERRESTRIAL MOLLUSCS					
Catinella exile	Pleistocene catinella	G1G2	S2		SC/N
Catinella gelida	a land snail	G2	S1S2		SC/N

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Cionella morseana	Appalachian pillar	G4G5	S2		SC/N
Gastrocopta procera	wing snaggletooth	G4G5	S3		THR
Glyphyalinia rhoadsi	sculpted glyph	G5	S2		SC/N
Glyphyalinia wheatleyi	bright glyph	G5	S1		SC/N
Guppya sterkii	brilliant granule	G4G5	S2S3		SC/N
Helicodiscus singleyanus	smooth coil	G4G5	S3		SC/N
Hendersonia occulta	cherrystone drop	G4	S3		THR
Hoyia sheldoni	**storm hydrobe**	**G1**	**S1**		**SC/N**
Paravitrea multidentata	dentate supercoil	G4G5	S2S3		SC/N
Physella magnalacustris	**Great Lakes physa**	**G2Q**	**SH**		**SC/N**
Planogyra asteriscus	eastern flat-whorl	G?	S1		SC/N
Pupoides albilabris	white-lip dagger	G5	S3		SC/N
Striatura ferrea	black striate	G4G5	**S2**		SC/N
Strobilops aeneus	bronze pinecone	G5	S1		SC/N
Strobilops affinis	eightfold pinecone	G?	S3		SC/N
Succinea bakeri	a land snail	G?	SU		SC/N
Vallonia excentrica	oval vallonia	G4G5	S3		SC/N
Vallonia perspectiva	thin-lip vallonia	G4G5	S3		SC/N
Valvata winnebagoensis	flanged valvata	G1G2	SU		SC/N
Vertigo elatior	tapered vertigo	G?	S3		SC/N
Vertigo hubrichti	Midwest Pleistocene vertigo	G2	S1		END
Vertigo iowaensis	Iowa Pleistocene vertigo	G2	S1S2		SC/N
Vertigo morsei	six-whorl vertigo	G?	S1		SC/N
Vertigo nylanderi	deep-throated vertigo	G?	S1		SC/N
Vertigo paradoxa	mystery vertigo	G2G4	S1		SC/N
Vertigo tridentata	honey vertigo	G4G5	S3		SC/N
Vitrina angelicae	transparent vitrine snail	G?	S1		SC/N
Zonitoides limatulus	dull gloss	G?	S1		SC/N
Zoogenetes harpa	boreal top	G?	S1		SC/N
RARE VASCULAR PLANTS					
Acer pensylvanicum	striped maple	G5	S1		SC
Aconitum noveboracense	northern wild monkshood	G3	S2	LT	THR
Adlumia fungosa	climbing fumitory	G4	S3		SC
Adoxa moschatellina	musk-root	G5	S2		THR
Agalinis gattingeri	roundstem foxglove	G4	S2		THR
Agalinis skinneriana	pale false foxglove	G3	**S2**		END
Agastache nepetoides	yellow giant hyssop	G5	**S3**		THR
Agrimonia parviflora	swamp agrimony	G5	S1		SC
Amerorchis rotundifolia	round-leaved orchis	G5	S1		THR
Ammannia robusta	**scarlet loosestrife**	**G5**	**S1**		**SC**
Anemone caroliniana	Carolina anemone	G5	S1		END
Anemone multifida var hudsoniana	early anemone	G5T5	S1		END
Arabis missouriensis var deamii	Deam's rockcress	**G4G5QT3?Q**	S3		SC
Arabis shortii	Short's rock-cress	G5	S2		SC
Arethusa bulbosa	swamp-pink	G4	S3		SC
Aristida dichotoma	Shinners three-awned grass	G5	S2		SC
Armoracia lacustris	lake-cress	G4?	S1		END
Artemisia dracunculus	dragon wormwood	G5	S2		SC
Artemisia frigida	prairie sagebrush	G5?	**S2S3**		SC
Asclepias lanuginosa	wooly milkweed	G4?	S1S2		THR
Asclepias ovalifolia	dwarf milkweed	G5?	S3		THR
Asclepias purpurascens	purple milkweed	G4G5	S2		END
Asclepias sullivantii	prairie milkweed	G5	S2		THR
Asplenium pinnatifidum	lobed spleenwort	G4	S1		THR
Asplenium trichomanes	maidenhair spleenwort	G5	S3		SC
Asplenium viride	green spleenwort	G4	S1		END
Aster dumosus var strictior	bushy aster	G5T4	S1		SC
Aster furcatus	forked aster	G3	S1S2		THR

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
Aster longifolius	long-leaved aster	G5	S1		SC
Astragalus alpinus	alpine milkvetch	G5	S1		END
Astragalus crassicarpus	ground-plum	G5	S2		END
Astragalus neglectus	Cooper's milkvetch	G4	S1		END
Baptisia tinctoria	yellow wild-indigo	**G5**	S1		SC
Bartonia paniculata	twining screwstem	G5	S1		SC
Bartonia virginica	yellow screwstem	G5	S3		SC
Besseya bullii	kitten tails	G3	S3		THR
Botrychium campestre	prairie dunewort	G3	S1		END
Botrychium lunaria	moonwort grape-fern	G5	S1		END
Botrychium minganense	Mingan's moonwort	G4	S2		SC
Botrychium mormo	little goblin moonwort	G3	**S2S3**		END
Botrychium oneidense	blunt-lobe grape-fern	G4Q	S2		SC
Botrychium rugulosum	rugulose grape-fern	G3	S2		SC
Botrychium spathulatum	spoon-leaf moonwort	**G3**	S1		SC
Cacalia muehlenbergii	great Indian-plantain	G4	S2		SC
Cacalia tuberosa	prairie Indian-plantain	G4G5	S2		THR
Cakile edentula	American sea-rocket	G5	S3		SC
Calamagrostis stricta	**slim-stem small reed grass**	**G5**	**S3**		**SC**
Calamintha arkansana	low calamint	G5	S2		SC
Calamovilfa longifolia var magna	sand-reed grass	G5T3T5	S2		THR
Callirhoe triangulata	clustered poppy-mallow	**G3**	S2S3		SC
Callitriche hermaphroditica	autumnal water-starwort	G5	S2		SC
Callitriche heterophylla	large water-starwort	G5	S2		THR
Caltha natans	floating marsh-marigold	G4G5	S1		END
Calylophus serrulatus	yellow evening-primrose	G5	**S2**		SC
Calypso bulbosa	fairy slipper	G5	**S3**		THR
Camassia scilloides	wild hyacinth	G4G5	**S1S2**		END
Cardamine maxima	large toothwort	G5Q	S1		SC
Cardamine pratensis	cuckooflower	G5	S3		SC
Carex artitecta	dry woods sedge	G5	S1		SC
Carex assiniboinensis	Assiniboine sedge	G4G5	**S3**		SC
Carex backii	Rocky Mountain sedge	G4	S2		SC
Carex capillaris	hair-like sedge	G5	S1		SC
Carex careyana	Carey's sedge	G5	S1		THR
Carex concinna	beautiful sedge	G4G5	S1		THR
Carex crawei	Crawe's sedge	G5	**S3**		SC
Carex crus-corvi	raven's foot sedge	G5	S1		END
Carex cumulata	clustered sedge	G4?	S2		SC
Carex exilis	coast sedge	G5	S1		THR
Carex folliculata	long sedge	G4G5	S3		SC
Carex formosa	handsome sedge	G4	**S2**		THR
Carex garberi	elk sedge	G4	S1		THR
Carex gracilescens	slender sedge	G5?	SH		SC
Carex gynocrates	northern bog sedge	G5	S2		SC
Carex laevivaginata	smooth-sheath sedge	G5	S1		END
Carex lenticularis	shore sedge	G5	**S2**		THR
Carex livida var radicaulis	livid sedge	G5T5	S2		SC
Carex longii	greenish-white sedge	G5	S1		SC
Carex lupuliformis	false hop sedge	**G4**	S1		END
Carex media	intermediate sedge	G5?	S1		END
Carex michauxiana	Michaux's sedge	G5	S1		THR
Carex nigra	smooth black sedge	G5	S1		SC
Carex pallescens var neogaea	pale sedge	G5T?Q	**S3**		SC
Carex platyphylla	broad-leaf sedge	G5	**S2**		SC
Carex prasina	drooping sedge	G4	S2S3		THR
Carex richardsonii	Richardson's sedge	G4	S3		SC
Carex schweinitzii	Schweinitz's sedge	G3	S1		END
Carex straminea	straw sedge	G5	**S1**		SC
Carex suberecta	prairie straw sedge	G4	S1		SC
Carex swanii	swan sedge	G5	SH		SC

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
Carex sychnocephala	many-headed sedge	G4	S2		SC
Carex tenuiflora	sparse-flowered sedge	G5	S3		SC
Carex torreyi	Torrey's sedge	G4	S1		SC
Carex vaginata	sheathed sedge	G5	S1		SC
Cassia marilandica	Maryland senna	G5	S1		SC
Catabrosa aquatica	brook grass	G5	S1		END
Ceratophyllum echinatum	prickly hornwort	G4?	S2		SC
Chaerophyllum procumbens	spreading chervil	G5	S1		SC
Cirsium flodmanii	Flodman's thistle	G5	S2		SC
Cirsium hillii	Hill's thistle	G3	S3		THR
Cirsium pitcheri	dune thistle	G3	S2	LT	THR
Clematis occidentalis	purple clematis	G5	S3		SC
Collinsonia canadensis	Canada horse-balm	G5	SH		END
Commelina erecta var deamiana	narrow-leaved dayflower	G5T5	S2		SC
Conioselinum chinense	hemlock parsley	G5	SH		END
Corallorhiza odontorhiza	autumn coral-root	G5	S3		SC
Crotalaria sagittalis	arrow-headed rattle-box	G5	S1		SC
Cypripedium arietinum	ram's-head lady's-slipper	G3	**S2**		THR
Cypripedium candidum	small white lady's-slipper	G4	S3		THR
Cypripedium parviflorum	small yellow lady's-slipper	G5	**S3**		SC
Cypripedium reginae	showy lady's-slipper	G4	**S3**		SC
Dalea villosa	silky prairie-clover	G5	S2		SC
Dasistoma macrophylla	mullein foxglove	G4	SH		SC
Deschampsia cespitosa	tufted hair grass	G5	S3		SC
Deschampsia flexuosa	crinkled hair grass	G5	S3		SC
Desmodium canescens	hoary tick-treefoil	G5	S1		SC
Diarrhena obovata	**beak grass**	**G4G5**	S1		END
Didiplis diandra	water-purslane	G5	S2		SC
Diodia teres var teres	buttonweed	**G5T5**	S1		SC
Diplazium pycnocarpon	glade fern	G5	S2		SC
Dodecatheon amethystinum	jewelled shooting-star	G4	S4		SC
Draba arabisans	rock whitlow-grass	G4	S1		SC
Draba lanceolata	lanceolate whitlow-cress	G3G5	S1		END
Drosera anglica	English sundew	G5	**S1**		THR
Drosera linearis	slenderleaf sundew	G4	S1		THR
Dryopteris clintoniana	Clinton's wood fern	G5	SH		SC
Dryopteris expansa	spreading wood fern	G5	S1		SC
Dryopteris filix-mas	male fern	G5	S1		SC
Dryopteris fragrans var remotiuscula	fragrant fern	G5T?	S2		SC
Echinacea pallida	pale-purple coneflower	**G4**	**S3**		THR
Echinodorus rostratus	erect burhead	G5	SH		SC
Eclipta alba	yerba de tajo	G?	S1		SC
Elatine triandra	longstem water-wort	G5	**S1**		SC
Eleocharis compressa	flat-stemmed spike-rush	G4	S2		SC
Eleocharis engelmannii	Engelmann spike-rush	G4?	S2		SC
Eleocharis mamillata	**spike-rush**	G4?	S1		SC
Eleocharis nitida	slender spike-rush	G3G4	S1		END
Eleocharis olivacea	capitate spike-rush	G5	S2		SC
Eleocharis quadrangulata	squarestem spike-rush	G4	SH		END
Eleocharis quinqueflora	few-flower spike-rush	G5	S2		SC
Eleocharis robbinsii	Robbins' spike-rush	G4G5	S3		SC
Eleocharis rostellata	beaked spike-rush	G5	S2		THR
Eleocharis wolfii	Wolf spike-rush	G3?	S1		END
Elymus lanceolatus ssp psammophilus	thickspike	G5T3	S2		THR
Epilobium palustre	marsh willow-herb	G5	**S3**		SC
Epilobium strictum	downy willow-herb	G5?	S2S3		SC
Equisetum palustre	marsh horsetail	G5	S2		SC
Equisetum variegatum	variegated horsetail	G5	S3		SC
Erigenia bulbosa	harbinger-of-spring	G5	S1		END

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Eriophorum chamissonis	russet cotton-grass	G5	S2		SC
Eupatorium sessilifolium var brittonianum	upland boneset	G5T?	S3		SC
Euphorbia commutata	wood spurge	G5	SH		SC
Euphorbia obtusata	bluntleaf spurge	G5	SH		SC
Euphorbia polygonifolia	seaside spurge	G5?	S2		SC
Festuca occidentalis	western fescue	G5	S1S2		THR
Festuca paradoxa	cluster fescue	G5	SH		SC
Fimbristylis puberula	hairy fimbristylis	G5	S1		END
Fraxinus quadrangulata	blue ash	G5	S1		THR
Fuirena pumila	dwarf umbrella-sedge	G4	S1		END
Galium palustre	marsh bedstraw	G5	S1		SC
Gentiana alba	yellow gentian	G4	**S3**		THR
Gentianopsis procera	lesser fringed gentian	G5	S3		SC
Geocaulon lividum	northern comandra	G5	S1		END
Geum macrophyllum var macrophyllum	large-leaved avens	G5T?	S1		SC
Geum macrophyllum var perincisum	large-leaved avens	**G5T5**	S3		SC
Glycyrrhiza lepidota	wild licorice	G5	S2		SC
Gnaphalium helleri	catfoot	G4G5	S1		SC
Gnaphalium obtusifolium var saxicola	cliff cudweed	G5T1T2	S1S2		THR
Gnaphalium sylvaticum	woodland cudweed	G5	S1		SC
Goodyera oblongifolia	giant rattlesnake-plantain	G5?	S3		SC
Gymnocarpium jessoense	northern oak fern	G5	**S1**		SC
Gymnocarpium robertianum	limestone oak fern	G5	S2		SC
Gymnocladus dioicus	Kentucky coffee-tree	G5	S3		SC
Hedyotis caerulea	innocence	G5	S3		SC
Hibiscus moscheutos ssp moscheutos	swamp rose mallow	**G5T5**	S1		SC
Huperzia appalachiana	Appalachian clubmoss	**G4G5**	S1		SC
Hybanthus concolor	green violet	G5	SH		SC
Hypericum sphaerocarpum	round-fruited St. John's-wort	G5	S2		THR
Iris lacustris	dwarf lake iris	G3	S2	LT	THR
Jeffersonia diphylla	twinleaf	G5	S2		SC
Juncus marginatus	grassleaf rush	G5	S2		SC
Juncus stygius	moor rush	G5	S1		END
Juncus vaseyi	Vasey's rush	G5?	S3		SC
Lespedeza leptostachya	prairie bush-clover	**G3**	S1	LT	END
Lespedeza violacea	violet bush-clover	G5	S2S3		SC
Lespedeza virginica	slender bush-clover	G5	S2		THR
Lesquerella ludoviciana	silver bladderpod	G5	S1		THR
Leucophysalis grandiflora	large-flowered ground-cherry	G3?	S2		SC
Liatris punctata var nebraskana	dotted blazing star	G5T3T5	S1S2		END
Liatris spicata	marsh blazing star	G5	S2S3		SC
Listera auriculata	auricled twayblade	G3	S1		END
Listera convallarioides	broad-leaved twayblade	G5	S1		THR
Lithospermum latifolium	American gromwell	G4	**S3**		SC
Littorella americana	American shore-grass	G5	S2		SC
Lonicera involucrata	fly honeysuckle	G4G5	S1		END
Lycopodium porophilum	rock clubmoss	G4	S3		SC
Lycopodium selago	fir clubmoss	G5	S1		SC
Malaxis brachypoda	white adder's-mouth	G4Q	**S3**		SC
Medeola virginiana	Indian cucumber-root	G5	S3		SC
Melica nitens	three-flower melic grass	G5	SH		SC
Melica smithii	Smith's melic grass	G4	S1		END
Minuartia dawsonensis	rock stitchwort	G5	S2		SC
Moehringia macrophylla	large-leaved sandwort	G4	S1		END
Muhlenbergia richardsonis	soft-leaf muhly	G5	S1		END
Myosotis laxa	small forget-me-not	G5	S2		SC
Myriophyllum farwellii	Farwell's water-milfoil	G5	**S3**		SC

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Napaea dioica	glade mallow	G3	S3		SC
Nothocalais cuspidata	prairie false-dandelion	G5	S2		SC
Nuphar advena	yellow water lily	G5T5	S2		SC
Onosmodium molle	marbleseed	G4G5	S3		SC
Ophioglossum pusillum	adder's-tongue	G5	S3		SC
Opuntia fragilis	brittle prickly-pear	G4G5	S3		THR
Orobanche fasciculata	clustered broomrape	G4	S1		THR
Orobanche ludoviciana	Louisiana broomrape	G5	S1		END
Orobanche uniflora	one-flowered broomrape	G5	S3		SC
Oryzopsis canadensis	Canada mountain-rice grass	G5	S1		SC
Osmorhiza chilensis	Chilean sweet cicely	G5	S3		SC
Oxytropis campestris var chartacea	Fassett's locoweed	G5T1	S1	LT	END
Panicum wilcoxianum	Wilcox's panic grass	G5	SH		SC
Parnassia palustris	marsh grass-of-parnassus	G5	S1		THR
Parnassia parviflora	small-flowered grass-of-parnassus	G4	S1		END
Parthenium integrifolium	American feverfew	G5	**S3**		THR
Pellaea atropurpurea	purple-stem cliff-brake	G5	S3		SC
Penstemon hirsutus	hairy beardtongue	G4	S2		SC
Penstemon pallidus	pale beardtongue	G5	**S2**		SC
Petasites sagittatus	arrow-leaved sweet-coltsfoot	G5	**S3**		THR
Phegopteris hexagonoptera	broad beech fern	G5	S2S3		SC
Phlox bifida	cleft phlox	G5?	S1		SC
Phlox glaberrima ssp interior	smooth phlox	G5T?	S1S2		END
Pinguicula vulgaris	common butterwort	G5	S1		END
Plantago cordata	heart-leaved plantain	G4	S1		END
Platanthera dilatata	leafy white orchis	G5	S3		SC
Platanthera flava var herbiola	pale green orchid	G4T4Q	**S2**		THR
Platanthera hookeri	Hooker's orchis	G5	S3		SC
Platanthera leucophaea	prairie white-fringed orchid	G2	S1	LT	END
Platanthera orbiculata	large roundleaf orchid	G5?	**S3**		SC
Platanus occidentalis	sycamore	G5	S2		SC
Poa paludigena	bog bluegrass	G3	**S2S3**		THR
Polanisia jamesii	James' cristatella	G5	SH		SC
Polemonium occidentale ssp lacustre	western Jacob's ladder	G5?T1Q	S1		END
Polygala cruciata	crossleaf milkwort	G5	**S3**		SC
Polygala incarnata	pink milkwort	G5	S1		END
Polystichum acrostichoides	Christmas fern	G5	S2		SC
Polystichum braunii	Braun's holly-fern	G5	S2		THR
Polytaenia nuttallii	prairie parsley	G5	**S3**		THR
Potamogeton confervoides	algae-like pondweed	**G4**	**S2**		THR
Potamogeton diversifolius	water-thread pondweed	G5	S2		SC
Potamogeton hillii	Hill's pondweed	G3	S1		SC
Potamogeton pulcher	spotted pondweed	G5	S1		END
Potamogeton vaginatus	sheathed pondweed	G5	S1		THR
Potamogeton vaseyi	Vasey's pondweed	G4	S2		SC
Prenanthes aspera	rough rattlesnake-root	G4?	S1		END
Prenanthes crepidinea	nodding rattlesnake-root	G3G4	S1		END
Primula mistassinica	bird's-eye primrose	G5	**S3**		SC
Psilocarya scirpoides	long-beaked bald rush	G4	S1		THR
Psoralea argophylla	silvery scurf-pea	G5	S1		SC
Psoralea esculenta	pomme-de-prairie	G5	S3		SC
Ptelea trifoliata	wafer-ash	G5	S2		SC
Pterospora andromedea	giant pinedrops	G5	S1		END
Pyrola minor	lesser wintergreen	G5	S1		END
Quercus palustris	pin oak	G5	S1		SC
Ranunculus cymbalaria	seaside crowfoot	G5	S3		THR
Ranunculus gmelinii	small yellow water crowfoot	G5	S1		END
Ranunculus lapponicus	Lapland buttercup	G5	S1		END
Rhamnus lanceolata var glabrata	lanced-leaved buckthorn	G5T4T5	S2		SC

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Rhexia virginica	Virginia meadow-beauty	G5	S2		SC
Rhododendron lapponicum	Lapland azalea	G5	S1		END
Rhus aromatica	fragrant sumac	G5	S2		SC
Rhynchospora fusca	brown beakrush	G4G5	S2		SC
Ribes hudsonianum	northern black currant	G5	S3		SC
Ribes oxyacanthoides	Canada gooseberry	G5	S1		THR
Rubus uniformis	uniform bramble	G4?Q	SH		SC
Ruellia humilis	hairy wild-petunia	G5	S2		END
Sagittaria calycina	long-lobe arrowhead	G5	**S1**		SC
Salix cordata	sand dune willow	G5	S1		END
Salix pellita	satiny willow	G5	S1		END
Salix planifolia	tea-leaved willow	G5	S1		THR
Salix sericea	silky willow	G5	**S1**		SC
Scirpus cespitosus	tufted club-rush	G5	S2		THR
Scirpus georgianus	Georgia bulrush	G5	SH		SC
Scirpus hallii	Hall's bulrush	G2	S1		END
Scirpus heterochaetus	slender bulrush	G5	S2		SC
Scirpus pallidus	pale bulrush	G5	SH		SC
Scirpus torreyi	Torrey's bulrush	G5?	S2S3		SC
Scleria reticularis	reticulated nutrush	**G4**	S1		END
Scleria triglomerata	whip nutrush	G5	**S2S3**		SC
Scleria verticillata	low nutrush	G5	S2		SC
Scutellaria ovata	heart-leaved skullcap	G5	S3S4		SC
Scutellaria parvula var parvula	small skullcap	**G4T4**	S1		END
Selaginella selaginoides	low spike-moss	G5	S1		END
Senecio congestus	marsh ragwort	G5	SH		SC
Senecio indecorus	plains ragwort	G5	S1		THR
Senecio plattensis	prairie ragwort	G5	S3S4		SC
Silene nivea	snowy campion	G4?	S2		THR
Silene virginica	fire pink	G5	S1		END
Sisyrinchium angustifolium	pointed blue-eyed-grass	G5	**S1**		SC
Solidago caesia	bluestem goldenrod	G5	S2		END
Solidago ohioensis	Ohio goldenrod	G4	S3		SC
Solidago sciaphila	shadowy goldenrod	**G3G4**	S3		SC
Solidago simplex var gillmanii	sticky goldenrod	G5T3?	S2		THR
Sparganium glomeratum	northern bur-reed	G4?	**S2**		THR
Spiranthes lucida	**shining lady's-tresses**	**G5**	**S1**		**SC**
Spiranthes ovalis var erostellata	October lady's-tresses	**G5?T4?**	S1		SC
Streptopus amplexifolius	white mandarin	G5	S3		SC
Strophostyles leiosperma	small-flowered woolly bean	G5	S2		SC
Talinum rugospermum	prairie fame-flower	G3G4	**S3**		SC
Tanacetum huronense	Lake Huron tansy	G4G5	S1		END
Thalictrum revolutum	waxleaf meadowrue	G5	S2		SC
Thalictrum venulosum	veined meadowrue	G5	S1		SC
Thaspium barbinode	hairy-jointed meadow-parsnip	G5	S1		END
Thaspium trifoliatum var flavum	purple meadow-parsnip	G5T5	S2		SC
Thelypteris simulata	bog fern	G4G5	S3		SC
Tiarella cordifolia	heart-leaved foam-flower	G5	S1		END
Tofieldia glutinosa	sticky false-asphodel	G5	S3		THR
Tomanthera auriculata	earleaf foxglove	G3	S1		SC
*Triglochin **maritima***	common bog arrow-grass	G5	S3		SC
Triglochin palustris	slender bog arrow-grass	G5	S3		SC
Trillium nivale	snow trillium	G4	**S3**		THR
Trillium recurvatum	reflexed trillium	G5	S3		SC
Triphora trianthophora	nodding pogonia	**G3G4**	S2		SC
Trisetum melicoides	purple false oats	G4	S1		END
Trisetum spicatum	narrow false oats	G5	S2		THR
Utricularia geminiscapa	hidden-fruited bladderwort	G4G5	S3		SC
Utricularia purpurea	purple bladderwort	G5	S3		SC
Utricularia resupinata	northeastern bladderwort	G4	**S3**		SC
Vaccinium cespitosum	dwarf huckleberry	G5	S1		END

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
Vaccinium pallidum	**Blue Ridge blueberry**	G5	S1		SC
Vaccinium vitis-idaea ssp minus	mountain cranberry	G5T5	S1		END
Valeriana sitchensis ssp uliginosa	marsh valerian	G4G5T4	S1		THR
Verbena simplex	narrow-leaved vervain	G5	S1		SC
Viburnum cassinoides	northern wild-raisin	G5	S2		SC
Viburnum edule	squashberry	G5	S1		END
Viburnum prunifolium	smooth black-haw	G5	S2		SC
Viola fimbriatula	sand violet	G5	S2		END
Viola rostrata	long-spur violet	G5	S2		SC
Woodsia oregana var cathcartiana	Oregon woodsia (tetraploid)	G5T5	S1		SC
RARE BRYOPHYTES - DRAFT					
Amblyodon dealbatus	a moss	G3G5	S1		SC
Anastrophyllum minutum var minutum	a liverwort	G5T5	S1		SC
Anthoceros macounii	a hornwort	G3G4	S1S2		SC
Anthoceros punctatus	a hornwort	G5	S1S2		SC
Aulacomnium androgynum	a moss	G5	S2		SC
Blindia acuta	a moss	G5	S1		SC
Brachythecium calcareum	a moss	G3G4	S3		SC
Buxbaumia aphylla	bug-on-a-stick	**G4G5**	S1		SC
Calliergon richardsonii	a moss	**G4**	S3		SC
Calliergon trifarium	a moss	G4	S1		SC
Calypogeia fissa	a liverwort	G5	S1		SC
Calypogeia sphagnicola	a liverwort	G5	S1		SC
Cephalozia lacinulata	a liverwort	G3	S1		SC
Cephaloziella divaricata	a liverwort	G5	S1		SC
Cephaloziella rubella var sullivantii	a liverwort	G5T3?Q	S1		SC
Dicranella cerviculata	a moss	**G5?**	S1		SC
Dicranella schreberiana var robusta	a moss	G5T?	S1		SC
Ditrichum flexicaule	a moss	G5	S1		SC
Drepanocladus simplicissimus	a moss	G1	S1		SC
Encalypta procera	extinguisher moss	G4G5	S2		SC
Entodon brevisetus	a moss	G4?	S4?		SC
Fontinalis flaccida	a water moss	G4G5	S1		SC
Fontinalis sphagnifolia	a water moss	G3G5	S2		SC
Frullania selwyniana	a liverwort	G2G3	S1		SC
Funaria americana	a moss	G2G3	S3?		SC
Grimmia pulvinata	a moss	G4G5	S1?		SC
Grimmia teretinervis	a moss	G3G5	S2		SC
Hyophila involuta	a moss	G4G5	S2		SC
Isopterygiopsis muelleriana	a moss	G5	S1		SC
Jaffueliobryum raui	a moss	G4?	S2		SC
Jaffueliobryum wrightii	a moss	**G4G5**	S2		SC
Jungermannia confertissima	a liverwort	**G5**	S1		SC
Jungermannia crenuliformis	a liverwort	G4	S1		SC
Jungermannia exsertifolia ssp cordifolia	a liverwort	**G5?T3T5**	S1		SC
Jungermannia gracillima	a liverwort	G5	S1		SC
Kurzia setacea	a liverwort	G4G5	S1		SC
Leucodon julaceus	a moss	G5	S2		SC
Lophozia ascendens	a liverwort	G4	S1		SC
Lophozia bicrenata	a liverwort	G5	S1		SC
Lophozia longidens	a liverwort	G5?	S1		SC
Lophozia ventricosa var longiflora	a liverwort	G5T3T5	S1		SC
Lophozia ventricosa var silvicola	a liverwort	G5T5	S1		SC
Mannia triandra	a liverwort	G3G4	S1		SC
Micromitrium megalosporum	a moss	G4	S2		SC

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
Moerckia hibernica	a liverwort	G4?	S1		SC
Mylia anomala	a liverwort	G5	S1		SC
Notothylas orbicularis	a hornwort	G5	S1S2		SC
Oxystegus spiralis	a moss	G1	S1		SC
Pallavicinia lyellii	a liverwort	G5	S1		SC
Physcomitrium hookeri	a moss	G2G4	S2		SC
Physcomitrium immersum	a moss	G2G3	S2		SC
Platydictya minutissima	a moss	G3	S3		SC
Pogonatum urnigerum	a moss	G5	S2		SC
Pohlia carnea	a moss	G?	S2		SC
Pohlia lescuriana	a moss	**G4?**	S2		SC
Pterigynandrum filiforme	a moss	G4G5	S1		SC
Racomitrium aciculare	a moss	G5	S1		SC
Racomitrium heterostichum	a moss	G5	S1		SC
Riccia beyrichiana	a liverwort	G5	S1?		SC
Riccia cavernosa	a liverwort	G5	S1?		SC
Riccia frostii	a liverwort	G5	S1?		SC
Riccia sorocarpa	a liverwort	G5	S1?		SC
Riccia sullivantii	a liverwort	G4Q	S1?		SC
Scapania carinthiaca	a liverwort	G3?	S1		SC
Scapania cuspiduligera	a liverwort	G5	S1		SC
Scapania degenii	a liverwort	G4?	S1		SC
Scapania saxicola	a liverwort	**G2G4**	S1		SC
Scapania scandica	a liverwort	**G5?**	S1		SC
Scapania umbrosa	a liverwort	G4G5	S1		SC
Schistostega pennata	luminous moss	G4	S1		SC
Schwetschkeopsis fabronia	a moss	G5	S1?		SC
Scorpidium scorpioides	a moss	G4G5	S1		SC
Seligeria calcarea	a moss	G4?	S1		SC
Seligeria donniana	a moss	G4G5	S1		SC
Sphagnum andersonianum	a peat moss	G3?	S2		SC
Sphagnum nitidum	a peat moss	G?	S2		SC
Sphagnum platyphyllum	a peat moss	G5	S1S2		SC
Sphagnum pulchrum	a peat moss	G5	S2		SC
Splachnum ampullaceum	a moss	G4	S2		SC
NATURAL COMMUNITIES					
FORESTS					
UPLAND TYPES					
Boreal forest	boreal forest	G3?	S2		NA
Central sands pine-oak forest	central sands pine-oak forest	G3	S3		NA
Forested ridge and swale	forested ridge and swale	G3	S2		NA
Hemlock relict	hemlock relict	G2Q	S2		NA
Mesic cedar forest	mesic cedar forest	G3?	S1		
Mesic floodplain terrace	mesic floodplain terrace		S2		
Northern dry forest	northern dry forest	G3?	S3		NA
Northern dry-mesic forest	northern dry-mesic forest	G4	S3		NA
Northern mesic forest	northern mesic forest	G4	S4		NA
Pine relict	pine relict	G4	S2		NA
Southern dry forest	southern dry forest	G4	S3		NA
Southern dry-mesic forest	southern dry-mesic forest	G4	S3		NA
Southern mesic forest	southern mesic forest	G3?	S3		NA
WETLAND TYPES					
Black spruce swamp	black spruce swamp	G5	S3?		NA
Floodplain forest	floodplain forest	G3?	S3		NA
Forested seep	forested seep		S2		NA

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
Hardwood swamp	hardwood swamp	G4	S3		NA
Northern wet forest	northern wet forest	G4	S4		NA
Northern wet-mesic forest	northern wet-mesic forest	G3?	S3S4		NA
Southern hardwood swamp	southern hardwood swamp	G4?	S2		NA
Southern tamarack swamp (rich)	**southern tamarack swamp (rich)**	G3	S3		NA
Tamarack (poor) swamp	tamarack (poor) swamp	G4	S3		NA
White pine-red maple swamp	white pine-red maple swamp	G3G4	S2		NA
SAVANNAS/WOODLANDS					
Cedar glade	cedar glade		S4		NA
Great lakes barrens	Great Lakes barrens	G2	S1		NA
Oak barrens	oak barrens	G2?	S2		NA
Oak opening	oak opening	G1	S1		NA
Oak woodland	oak woodland		S1?		NA
Pine barrens	pine barrens	G2	S2		NA
SHRUB COMMUNITIES					
Alder thicket	alder thicket	G4	S4		NA
Bog relict	bog relict	G3	S3		NA
Muskeg	muskeg		S4		NA
Open bog	open bog	G5	S4		NA
Patterned peatland	patterned peatland		S1		NA
Shrub-carr	shrub-carr	G5	S4		NA
HERBACEOUS COMMUNITIES					
UPLAND TYPES					
Bracken grassland	bracken grassland	G3	S2		NA
Dry prairie	dry prairie	G3	S3		NA
Dry-mesic prairie	dry-mesic prairie	G3	S2		NA
Mesic prairie	mesic prairie	G2	S1		NA
Sand barrens	sand barrens		SU		NA
Sand prairie	sand prairie		S2		NA
WETLAND TYPES					
Boreal rich fen	boreal rich fen	G4G5	S2		NA
Calcareous fen	calcareous fen	G3	S3		NA
Central poor fen	central poor fen		S3		NA
Coastal plain marsh	coastal plain marsh	G2?	S1		NA
Emergent aquatic	emergent aquatic	G4	S4		NA
Emergent aquatic - wild rice	emergent aquatic - wild rice	G?	S3		NA
Interdunal wetland	interdunal wetland	G2?	S1		NA
Moist sandy meadow	**moist sandy meadow**		**SU**		**NA**
Northern sedge meadow	northern sedge meadow	G4	S3		NA
Poor fen	poor fen	G3G4	S3		NA
Shore fen	shore fen		S2		NA
Southern sedge meadow	southern sedge meadow	G4	S3		NA
Submergent aquatic	submergent aquatic		S4		NA
Submergent aquatic - oligotrophic	submergent aquatic - oligotrophic		S3		NA
Wet prairie	wet prairie	G3	SU		NA
Wet-mesic prairie	wet-mesic prairie	G2	S2		NA

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
GEOLOGICAL FEATURES/PRIMARY COMMUNITIES					
Algific talus slope	algific talus slope	G2	S1		NA
Alvar	alvar	G2	S1		NA
Bedrock glade	bedrock glade	G3?	S3		NA
Bedrock shore	bedrock shore		S2		NA
Clay seepage bluff	**clay seepage bluff**		**S2**		**NA**
Dry cliff	dry cliff		S4		NA
Felsenmeer	glaciere talus		S2		NA
Great Lakes alkaline rockshore	Great Lakes alkaline rockshore	G3	S2		NA
Great Lakes beach	Great Lakes beach	G3	S2		NA
Great Lakes dune	Great Lakes dune	G3	S2		NA
Inland beach	inland beach	G4G5	S3		NA
Moist cliff	moist cliff		S4		NA
Talus forest	talus forest		S1		NA
LAKES					
Lake--hard bog	lake--hard bog	GU	S2		NA
Lake--soft bog	lake--soft bog	GU	S4		NA
Lake--deep, hard, drainage	lake--deep, hard, drainage	GU	S3		NA
Lake--deep, soft, drainage	lake--deep, soft, drainage	GU	S1		NA
Lake--shallow, hard, drainage	lake--shallow, hard, drainage	GU	SU		NA
Lake--shallow, very hard, drainage (marl)	lake--shallow, very hard, drainage (marl)	GU	S2		NA
Lake--shallow, soft, drainage	lake--shallow, soft, drainage	GU	S3		NA
Ephemeral pond	ephemeral pond	G?Q	SU		NA
Lake--meromictic	lake--meromictic	GU	S1		NA
Lake--oxbow	lake--oxbow		SU		NA
Lake--deep, hard, seepage	lake--deep, hard, seepage	GU	S2		NA
Lake--deep, soft, seepage	lake--deep, soft, seepage	GU	S3		NA
Lake--deep, very soft, seepage	lake--deep, very soft, seepage	GU	S3		NA
Lake--shallow, hard, seepage	lake--shallow, hard, seepage	GU	SU		NA
Lake--shallow, soft, seepage	lake--shallow, soft, seepage	GU	S4		NA
Spring pond	spring pond	GU	S3		NA
Lake--spring	lake--spring		S3		NA
Lake--unique	lake--unique		SU		NA
STREAMS					
Springs and spring runs, hard	springs and spring runs, hard	GU	S4		NA
Springs and spring runs, soft	springs and spring runs, soft		SU		NA
Stream--fast, hard, cold	stream--fast, hard, cold	GU	S4		NA
Stream--fast, hard, warm	stream--fast, hard, warm		SU		NA
Stream--fast, soft, cold	stream--fast, soft, cold	GU	SU		NA
Stream--fast, soft, warm	stream--fast, soft, warm		SU		NA
Stream--slow, hard, cold	stream--slow, hard, cold		SU		NA
Stream--slow, hard, warm	stream--slow, hard, warm		SU		NA
Stream--slow, soft, cold	stream--slow, soft, cold		SU		NA
Stream--slow, soft, warm	stream--slow, soft, warm		SU		NA
MISCELLANEOUS ELEMENTS					
Bat hibernaculum	bat hibernaculum		S3		SC
Bird rookery	bird rookery		SU		SC
Cave	cave		SU		NA
Herp hibernaculum	herp hibernaculum		SU		SC
Migratory bird concentration site	migratory bird concentration site		SU		SC
Mussel bed	mussel bed		S3?		SC

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
ELEMENTS NOT ACTIVELY BEING TRACKED (DATA ARE BEING COLLECTED)					
MAMMALS					
Lynx canadensis	lynx	G5	SA	LT	SC/P
Lynx rufus	bobcat	G5	S4		SC/H
Sorex fumeus	**smokey shrew**	**G5**	**SRF**		**SC/N**
BIRDS					
Accipiter cooperii	Cooper's hawk	G5	S2N,S4B		SC/M
Anas discors	Blue-winged Teal	G5	S3S4B,SZN		SC/M
Catharus fuscescens	Veery	G5	S3S4B,SZN		SC/M
Cistothorus platensis	Sedge Wren	G5	S4B,SZN		SC/M
Dolichonyx oryzivorus	Bobolink	G5	S3S4B,SZN		SC/M
Hylocichla mustelina	Wood Thrush	G5	S4B,SZN		SC/M
Laterallus jamaicensis	Black Rail	G4	SR		SC/M
Pooecetes gramineus	Vesper Sparrow	G5	S3S4B,SZN		SC/M
Progne subis	Purple Martin	G5	**S4S5B,SZN**		SC/M
Regulus calendula	Ruby-crowned Kinglet	G5	S3B,SZN		SC/M
Spizella pusilla	Field Sparrow	G5	S3S4B,SZN		SC/M
Sturnella magna	Eastern Meadowlark	G5	S4		SC/M
Surnia ulula	Northern Hawk Owl	G5	SAB,SAN		SC/M
Thryothorus ludovicianus	Carolina Wren	G5	SA		SC/M
Tyrannus verticalis	Western Kingbird	G5	SAB,SZN		SC/M
Vermivora chrysoptera	Golden-winged Warbler	G4	S4?		SC/M
Vermivora ruficapilla	Nashville Warbler	G5	S4?		SC/M
Vireo philadelphicus	Philadelphia Vireo	G5	SUB,SZN		SC/M
Wilsonia pusilla	Wilson's Warbler	G5	SUB,SZN		SC/M
REPTILES AND AMPHIBIANS					
Rana palustris	pickerel frog	G5	S3S4		SC/H
MUSSELS					
Actinonaias ligamentina	mucket	G5	S4		SC/H
Lasmigona compressa	creek heelsplitter	G5	S3S4		SC/H
Ligumia recta	black sandshell	G5	S3		SC/H
Pleurobema rubrum	pyramid pigtoe	G2	SR		SC/H
Utterbackia imbecillis	paper pondshell	G5	S4		SC/H
BUTTERFLIES AND MOTHS					
Amblyscirtes hegon	pepper and salt skipper	G5	SU		SC/N
Atrytone arogos iowa	Iowa skipper	G3G4T3T4	SR		
Coenonympha tullia	inornate ringlet	G5	S3S4		SC/N
Colias interior	pink-edged sulphur	G5	S4?		SC/N
Euphyes conspicua	black dash	G4	S3S4		SC/N
Everes amyntula	western tailed blue	G5	SU		SC/N
Feniseca tarquinius	harvester	G4	S3		SC/N
Phoebis sennae	cloudless sulpher	G5	SA		SC/N
Pieris oleracea	mustard white	G4G5	S4		SC/N
DRAGONFLIES AND DAMSELFLIES					
Tramea onusta	red-mantled glider	G5	S3		SC/N
MISCELLANEOUS					

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
INVERTEBRATES					
Cicindela splendida	a tiger beetle	G5	S3S4		SC/N
Craspedacusta sowerbyi	freshwater jellyfish	G5	SU		SC/N
Euchemotrema hubrichti	carinate pillsnail	G1	SR		SC/N
Euklastus harti	a Derbid plant hopper	G?	SR		SC/N
Fallicambarus fodiens	a crayfish	G5	SR		SC/N
Gastrocopta corticaria	bark snaggletooth	G4G5	S3S4		SC/N
Hydroperla crosbyi	a stonefly	G5	SR		SC/N
Ilybius angustior	**a predaceous diving beetle**	**G?**	**SU**		**SC/N**
Ilybius pleuriticus	**a predaceous diving beetle**	**G?**	**SU**		**SC/N**
Polycentropus weedi	a caddisfly	G?	SU		SC/N
Scudderia fasciata	black-striped katydid	G?	SU		SC/N
Striatura exigua	ribbed striate	G4	S3S4		SC/N
Vertigo bollesiana	delicate vertigo	G3	S3S4		SC/N
Vertigo brierensis	Briarton Pleistocene snail	G1	SR		SC/N
PLANTS					
Coreopsis lanceolata var lanceolata	sand coreopsis	G5T?	S2		SC
Hydrastis canadensis	golden-seal	G4	S3S4		SC
Juglans cinerea	butternut	G3G4	S3?		SC
Panax quinquefolius	American ginseng	**G3G4**	S4		SC
Taxus canadensis	Canadian yew	G5	S4		SC
WISCONSIN'S EXTIRPATED SPECIES					
MAMMALS					
Bison bison	bison	G4	SX		
Cervus elaphus	elk	G5	SX		
Cryptotis parva	least shrew	G5	SX		
Gulo gulo	wolverine	G4	SX		
Rangifer tarandus	caribou	G5	SX		
Rangifer tarandus caribou	woodland caribou	G5T4	SX	LE	SC/FL
BIRDS					
Conuropsis carolinensis	Carolina Parakeet	GX	SX		
Ectopistes migratorius	Passenger Pigeon	GX	SX		
Elanoides forficatus	American Swallow-tailed Kite	G5	SXB,SZN		
Falco peregrinus anatum	American Peregrine Falcon	G4T3	SX		
Grus americana	Whooping Crane	G1	SXB,SZN	XN	SC/FL
Numenius americanus	Long-billed Curlew	G5	SXB,SZN		
Thryomanes bewickii	**Bewick's Wren**	**G5**	**SXB,SZN**		**END**
FISH					
Coregonus johannae	deepwater cisco	GX	SX		
Erimyzon oblongus	creek chubsucker	G5	SX		
Notropis buchanani	ghost shiner	G5	SX		
Notropis chalybaeus	ironcolor shiner	**G4**	SX		
MUSSELS					
Leptodea leptodon	scaleshell	G1	SX	**LE**	**SC/FL**
Potamilus capax	fat pocketbook	G1	SX	LE	SC/FL
PLANTS					
Asclepias meadii	Mead's milkweed	G2	SX	LT	SC/FL

Scientific Name	Common Name	Global Rank	State Rank	US ESA Status	WI Status
Collinsia verna	spring blue-eyed mary	G5	SX		
Eleocharis equisetoides	horse-tail spike-rush	G4	SX		

APPENDIX 4. ABREVIATED LIST OF NHI NATURAL COMMUNITIES ASSOCIATED WITH THE NIAGARA ESCARPMENT

The Wisconsin Natural Heritage Inventory's recognized Natural Communities – Working Document. Prepared by Eric Epstein, Emmet Judziewicz and Elizabeth Spencer.

This document will be periodically updated and expanded. Future editions will include or be linked to additional descriptive information, range maps, and crosswalks to other vegetation classification systems.

Algific Talus Slope

This rare community of southwestern Wisconsin's Driftless Area consists of steep slopes of fractured limestone (dolomite) rock that retains ice and emits cold air throughout the growing season. The cold microhabitats enable the persistence of northern species and "periglacial relicts" such as northern monkshood (*Aconitum noveboracense*) and rare terrestrial snails. The woody overstory is often sparse, with scattered small black ash (*Fraxinus nigra*) and white birch (*Betula papyrifera*). Mountain maple (*Acer spicatum*), a northern shrub, may be frequent and extensive beds of bulblet fern (*Cystopteris bulbifera*) and mosses are characteristic.

Talus slope with a dense growth of Cystopteris fragilis beneath the escarpment. Peninsula State Park, June 25, 2000. Photo by Gary Fewless.

Alkaline Clay Bluff

Steep, clay bluffs occur along some stretches of the Great Lakes shorelines and less commonly inland on streams draining into Lake Superior and Lake Michigan. Vegetative cover ranges from forested with pines (*Pinus resinosa* and *P. strobus*), white cedar (*Thuja occidentalis*) and white birch (*Betula papyrifera*), to bare clay with only a few herbs present. Buffaloberry (*Sheperdia canadensis*) is a characteristic shrub, but more typically, alders (*Alnus incana* and *A. crispa*), as well as herbs such as Canada goldenrod (*Solidago canadensis*) and pearly everlasting (*Anaphalis margaritacea*) are prevalent. Both native and exotic pioneers such as fireweed (*Epilobium angustifolium*) and Canada thistle (*Cirsium arvense*) are common, especially on unstable sites. But it is the semi-stabilized "weeping" bluffs that are of the greatest biological interest. Golden sedge (*Carex aurea*), orchids and calciphilic fen species may colonize such sites, which can be local repositories of rare or otherwise noteworthy species.

Alvar

This rare community consists of areas of thin discontinuous soil overlying horizontal beds of limestone or dolomite in the vicinity of Great Lakes shorelines. They are characterized by

relatively low tree cover and a distinctive biota which includes elements of rock pavement, prairie, savanna and boreal forest communities. Among these are regional endemics, some very rare. Small coniferous and deciduous trees (cedar, fir, pine, oak, aspen, birch) are scattered among an assemblage of species that can include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indian-grass (*Sorghastrum nutans*), and wood lily (*Lilium philadelphicum*), as well as shoreline plants such as silverweed (*Potentilla anserina*) and dwarf lake iris (*Iris lacustris*).

Bedrock Shore

Wave-splashed bedrock shoreline ledges are best developed on sandstone in the Apostle Islands of Lake Superior. Stunted trees of white cedar (*Thuja occidentalis*), white birch (*Betula papyrifera*), showy mountain-ash (*Sorbus decora*) and green alder (*Alnus crispa*) are often present in crevices. Common herbs are ticklegrass (*Agrostis hyemalis*), fireweed (*Epilobium angustifolium*), and Canada goldenrod (*Solidago canadensis*), but the flora often includes unusual plants such as bird's-eye primrose (*Primula mistassinica*), brook lobelia (*Lobelia kalmii*), and three-toothed cinquefoil (*Potentilla tridentata*).

Boreal Forest

In Wisconsin, mature stands of this forest community are dominated by white spruce (*Picea glauca*) and balsam-fir (*Abies balsamea*), often mixed with white birch (*Betula papyrifera*), white cedar (*Thuja occidentalis*), white pine (*Pinus strobus*), balsam-poplar (*Populus balsamifera*) and quaking aspen (*Populus tremuloides*). Mountain-ash (*Sorbus* spp.) may also be present. Common understory herbs are large-leaved aster (*Aster macrophyllus*), bluebead lily (*Clintonia borealis*), Canada mayflower (*Maianthemum canadense*), wild sarsaparilla (*Aralia nudicaulis*), and bunchberry (*Cornus canadensis*). Most Wisconsin stands are associated with the Great Lakes, especially the clay plain of Lake Superior, and the eastern side of the northern Door Peninsula on Lake Michigan. Of potential interest from the perspectives of vegetation classification and restoration, white pine had the highest importance value of any tree in the Lake Superior region, as recorded during the original land survey of the mid-1800's.

Boreal Rich Fen

Neutral to alkaline cold open peatlands of northern Wisconsin through which carbonate-rich groundwater percolates. Sphagnum mosses are absent or of relatively minor importance, as calciphilic species (especially the "brown" mosses) predominate. Dominant/characteristic plants include woolly sedge (*Carex lasiocarpa*), twig rush (*Cladium mariscoides*), beaked bladderwort (*Utricularia cornuta*), rushes (*Juncus* spp.), and Hudson Bay cotton-grass (*Scirpus hudsonianus*). Shrubby phases also occur, with bog birch (*Betula pumila*), sage willow (*Salix candida*), and speckled alder (*Alnus incana*) present in significant amounts.

Braken Grassland

There is disagreement on whether bracken grassland should be considered a "natural community" in Wisconsin and elsewhere in the Upper Great Lakes region.

Calcareous Fen

An open wetland found in southern Wisconsin, often underlain by a calcareous substrate, through which carbonate-rich groundwater percolates. The flora is typically diverse, with many calciphiles. Common species are several sedges (*Carex sterilis* and *C. lanuginosa*), marsh fern (*Thelypteris palustris*), shrubby cinquefoil (*Potentilla fruticosa*), shrubby St. John's-wort (*Hypericum kalmianum*), Ohio goldenrod (*Solidago ohioensis*), grass-of-parnassus (*Parnassia glauca*), twig-rush (*Cladium mariscoides*), brook lobelia (*Lobelia kalmii*), boneset (*Eupatorium perfoliatum*), swamp thistle (*Cirsium muticum*), and asters (*Aster* spp.). Some fens have significant prairie or sedge meadow components, and intergrade with those communities.

Cedar Glade

Dry sandstone, quartzite or dolomite exposures vegetated with dense thickets of red cedar (*Juniperus virginiana*). Red maple (*Acer rubrum*), paper birch (*Betula papyrifera*) and black and bur oaks (*Quercus velutina* and *Q. macrocarpa*) may also be present. This community is usually if not always the result of fire suppression on dry prairies, and in pre-settlement times it may have occurred only where extensive cliffs served as firebreaks. Common herbs include bluestem and grama grasses (*Andropogon* spp. and *Bouteloua* spp.), prickly-pear cactus (*Opuntia compressa*), flowering spurge (*Euphorbia corollata*), stiff sandwort (*Arenaria stricta*), and gray goldenrod (*Solidago nemoralis*).

Dry Cliff

These dry vertical bedrock exposures occur on many different rock types, which may influence species composition. Scattered pines, oaks, or shrubs often occur. However, the most characteristic plants are often the ferns, common polypody (*Polypodium vulgare*) and rusty woodsia (*Woodsia ilvensis*), along with herbs such as columbine (*Aquilegia canadensis*), harebell (*Campanula rotundifolia*), pale corydalis (*Corydalis sempervirens*), juneberry (*Amelanchier* spp.), bush-honeysuckle (*Diervilla lonicera*), and rock spikemoss (*Selaginella rupestris*).

Dry Prairie

This grassland community occurs on dry, often loess-derived soils, usually on steep south or west facing slopes or at the summits of river bluffs with sandstone or dolomite near the surface. Short to medium-sized prairie grasses: little bluestem (*Schizachyrium scoparium*), side-oats grama (*Bouteloua curtipendula*), hairy grama (*B. hirsuta*), and prairie dropseed (*Sporobolus heterolepis*), are the dominants in this community. Common shrubs and forbs include lead plant (*Amorpha canescens*), silky aster (*Aster sericeus*), flowering spurge (*Euphorbia corollata*), purple prairie-clover (*Petalostemum purpureum*), cylindrical blazing-star (*Liatris cylindracea*), and gray goldenrod (*Solidago nemoralis*). Stands on gravelly knolls in the Kettle Moraine region of southeastern Wisconsin and along the St. Croix River on the Minnesota – Wisconsin border may warrant recognition, at least at the subtype level.

Emergent Aquatic

These open, marsh, lake, riverine and estuarine communities with permanent standing water are dominated by robust emergent macrophytes, in pure stands of single species or in various

mixtures. Dominants include cat-tails (*Typha* spp.), bulrushes (particularly *Scirpus acutus*, *S. fluviatilis*, and *S. validus*), bur-reeds (*Sparganium* spp.), giant reed (*Phragmites australis*), pickerel-weed (*Pontederia cordata*), water-plantains (*Alisma* spp.), arrowheads (*Sagittaria* spp.), and the larger species of spikerush such as (*Eleocharis smallii*).

Emergent Aquatic - Wild Rice

This open community is an emergent macrophyte type, with wild rice (*Zizania aquatica* or *Z. palustris*) as the dominant species. The substrate usually consists of poorly-consolidated, semi-organic sediments. Water fertility is low to moderate, and a slow current is present. Wild rice beds have great cultural significance to native peoples, and are important wildlife habitats.

Ephemeral Pond

These ponds are depressions with impeded drainage (usually in forest landscapes), that hold water for a period of time following snowmelt but typically dry out by mid-summer. Common aquatic plants of these habitats include yellow water crowfoot (*Ranunculus flabellaris*), mermaid weed (*Proserpinaca palustris*), Canada bluejoint grass (*Calamagrostis canadensis*), floating manna grass (*Glyceria septentrionalis*), spotted cowbane (*Cicuta maculata*), smartweeds (*Polygonum* spp.), orange jewelweed (*Impatiens capensis*), and sedges. Ephemeral ponds provide critical breeding habitat for certain invertebrates, as well as for many amphibians such as frogs and salamanders.

Felsenmeer
(Description in preparation)

Forested Ridge and Swale

This is a complex of semi- to fully-stabilized, often forested beach / dune ridges alternating with wet open to forested swales, found on the shores of the Great Lakes but best-developed along Lake Michigan. Both parallel the coast and offer exceptionally complex and diverse habitats for wetland, upland, and Great Lakes shoreline plants. Ridges may support assemblages similar to boreal, northern mesic, or northern dry-mesic forests. Water depth is a controlling factor in the swales, and the vegetation may run the gamut from open (emergent marsh, fen, or sedge meadow), shrub (bog birch, alder), or forested wetlands (often white cedar, black ash are prominent in these).

Forested Seep

These are shaded seepage areas with active spring discharges in (usually) hardwood forests that may host a number of uncommon to rare species. The overstory dominant is frequently black ash (*Fraxinus nigra*), but yellow birch (*Betula allegheniensis*), American elm (*Ulmus americana*) and many other tree species may be present including conifers such as hemlock (*Tsuga canadensis*) or white pine (*Pinus strobus*). Understory species include skunk cabbage (*Symplocarpus foetidus*), water-pennywort (*Hydrocotyle americana*), marsh blue violet (*Viola cucullata*), swamp saxifrage (*Saxifraga pennsylvanica*), golden saxifrage (*Chysosplenium americanum*), golden ragwort (*Senecio aureus*), silvery spleenwort (*Athyrium thelypterioides*)

and the rare sedges (*Carex scabrata* and *C. prasina*). Most documented occurrences are in the Driftless Area, or locally along major rivers flanked by steep bluffs.

Great Lakes Alkaline Rockshore

These are creviced, wave-splashed, nearly horizontal dolomite ledges along Lake Michigan on the Door Peninsula. Depending on lake levels, large expanses of this habitat may be either inundated or exposed during a given year. Common members of this community are the shrubs ninebark (*Physocarpus opulifolius*), shrubby cinquefoil (*Potentilla fruticosa*), and the herbs silverweed (*Potentilla anserina*), goldenrods (especially *Solidago hispida*), brook lobelia (*Lobelia kalmii*), gentians (*Gentiana* spp.), grasses-of Parnassus (*Parnassia* spp.), Indian paint-brush (*Castilleja coccinea*), low calamint (*Calamintha arkansana*), and many other calciphiles. Plants endemic to the Great Lakes shores are significant components of some stands.

Great Lakes Barrens

In Wisconsin, this variant of pine savanna is known from only one sandy site on Lake Superior. The dominant trees in this open stand are wind- and fire-deformed trees, red pines (*Pinus resinosa*) with white pine (*P. strobus*) also present. The understory consists of dense growths of lichens with scattered thickets of common juniper (*Juniperus communis*), early blueberry (*Vaccinium angustifolium*), and huckleberry (*Gaylussacia baccata*). Other common plants are hairgrass (*Deschampsia flexuosa*), ticklegrass (*Agrostis hyemalis*), false-heather (*Hudsonia tomentosa*), and bearberry (*Arctostaphylos uva–ursi*).

Great Lakes Beach

This beach community usually occurs in association with active dune systems. The beaches of the Great Lakes are extremely dynamic features, strongly influenced by water level changes and storm events. They support a suite of very specialized organisms, although unprotected shorelines may be entirely unvegetated. The plant species found in this community include (along Lake Michigan) seaside spurge (*Euphorbia polygonifolia*) and American sea-rocket (*Cakile edentula*).

Great Lakes Dune (formerly called Lake Dune)

The dominant plant in these semi-stabilized, open dunes along Great Lakes shorelines, is usually the sand-binding marram grass (*Ammophila breviligulata*). Frequent associates are common juniper (*Juniperus communis*), Canada wild-rye (*Elymus canadensis*), false-heather (*Hudsonia tomentosa*), beach-pea (*Lathyrus japonicus*), beach wormwood (*Artemisia campestris*), sand cherry (*Prunus pumila*), and various willows (*Salix* spp.). Two plants endemic to the Great Lakes region, pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*; possibly now extirpated in Wisconsin), occur in this community along Lake Michigan.

Interdunal Wetland

Wind-created hollows that intersect the water table within active dune fields along the Great Lakes. These maybe colonized by wetland plants, including habitat specialists that are of high conservation significance. Common members of this wetland community on Lake Superior are twig-rush (*Cladium mariscoides*), species of rushes (especially *Juncus balticus*), pipewort

(*Eriocaulon septangulare*), the sedge (*Carex viridula*), ladies-tress orchids (*Spiranthes* sp.) and bladderworts (*Utricularia cornuta* and *U. resupinata*).

Mesic Cedar Forest

This is a rare upland forest community of mesic sites in northern Wisconsin, characterized by white cedar (*Thuja occidentalis*) and various associates including hemlock (*Tsuga canadensis*), white spruce (*Abies balsamea*), yellow birch (*Betula alleghanensis*), and white pine (*Pinus strobus*). The herb layer may contain Canada mayflower (*Maianthemum canadense*), twinflower (*Linnaea borealis*), clubmosses (*Lycopodium* spp.), and others. More information is needed on this community type.

Moist Cliff

This "micro-community" occurs on shaded (by trees or the cliff itself because of aspect), moist to seeping mossy, vertical exposures of various rock types, most commonly sandstone and dolomite. Common species are columbine (*Aquilegia canadensis*), the fragile ferns (*Cystopteris bulbifera* and *C. fragilis*), wood ferns (*Dryopteris* spp.), rattlesnake-root (*Prenanthes alba*), and wild sarsaparilla (*Aralia nudicaulis*). The rare flora of these cliffs vary markedly in different parts of the state; Driftless Area cliffs might have northern monkshood (*Aconitum noveboracense*), those on Lake Superior, butterwort (*Pinguicula vulgaris*), or those in Door County, green spleenwort (*Asplenium viride*).

Northern Mesic Forest

This forest complex covered the largest acreage of any Wisconsin vegetation type prior to European settlement. Sugar maple (*Acer saccharum*) is dominant or co-dominant in most stands, while hemlock (*Tsuga canadensis*) was the second most important species, sometimes occurring in nearly pure stands with white pine (*Pinus strobus*). Beech (*Fagus grandifolia*) can be a co-dominant with sugar maple in the counties near Lake Michigan. Other important tree species were yellow birch (*Betula allegheniensis*), basswood (*Tilia americana*), and white ash (*Fraxinus americana*). The groundlayer varies from sparse and species poor (especially in hemlock stands) with woodferns (especially *Dryopteris intermedia*), bluebead lily (*Clintonia borealis*), clubmosses (*Lycopodium* spp.), and Canada mayflower (*Maianthemum canadense*) prevalent, to lush and species-rich with fine spring ephemeral displays. After old-growth stands were cut, trees such as quaking and bigtoothed aspens (*Populus tremuloides* and *P. grandidentata*), white birch (*Betula papyrifera*), and red maple (*Acer rubrum*) became and still are important in many second-growth Northern Mesic Forests. Several distinct associations within this complex warrant recognition as communities, and draft abstracts of these are currently undergoing review.

Northern Sedge Meadow

This open wetland community is dominated by sedges and grasses. There are several common subtypes: tussock meadows, dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*); broad-leaved sedge meadows, dominated by the robust sedges (*Carex lacustris* and/or *C. utriculata*); and wire-leaved sedge meadows, dominated by such species as woolly sedge (*Carex lasiocarpa*) and few-seeded sedge (*C. oligosperma*).

Frequent associates include marsh bluegrass (*Poa palustris*), manna grasses (*Glyceria* spp.), panicled aster (*Aster lanceolatus*), joy-pye-weed (*Eupatorium maculatum*), and the bulrushes (*Scirpus atrovirens* and *S. cyperinus*).

Northern Wet-Mesic Forest

This forested minerotrophic wetland is dominated by white cedar (*Thuja occidentalis*), and occurs on rich, neutral to alkaline substrates. Balsam fir (*Abies balsamea*), black ash (*Fraxinus nigra*), and spruces (*Picea glauca* and *P. mariana*) are among the many potential canopy associates. The understory is rich in sedges (such as *Carex disperma* and *C. trisperma*), orchids (e.g., *Platanthera obtusata* and *Listera cordata*), and wildflowers such as goldthread (*Coptis trifolia*), fringed polygala (*Polygala pauciflora*), and naked miterwort (*Mitella nuda*), and trailing sub-shrubs such as twinflower (*Linnaea borealis*) and creeping snowberry (*Gaultheria hispidula*). A number of rare plants occur more frequently in the cedar swamps than in any other habitat.

Oak Barrens

Black oak (*Quercus velutina*) is the dominant tree in this fire-adapted savanna community of xeric sites, but other oaks may also be present. Common understory species are lead plant (*Amorpha canescens*), black-eyed susan (*Rudbeckia hirta*), round-headed bush clover (*Lespedeza capitata*), goat's rue (*Tephrosia virginiana*), june grass (*Koeleria cristata*), little bluestem (*Schizachyrium scoparium*), flowering spurge (*Euphorbia corollata*), frostweed (*Helianthemum canadense*), false Solomon's-seals (*Smilacina racemosa* and *S. stellata*), spiderwort (*Tradescantia ohioensis*), and lupine (*Lupinus perennis*). Distribution of this community is mostly in southwestern, central and west central Wisconsin.

Oak Opening

As defined by Curtis, this is an oak-dominated savanna community in which there is less than 50% tree canopy. Historically, oak openings occurred on wet-mesic to dry sites. The few extant remnants are mostly on drier sites, with the mesic and wet-mesic openings almost totally destroyed by conversion to agricultural or residential uses, and by the encroachment of other woody plants due to fire suppression. Bur, white, and black oaks (*Quercus macrocarpa*, *Q. alba*, and *Q. velutina*) are dominant in mature stands as large, open-grown trees with distinctive limb architecture. Shagbark hickory (*Carya ovata*) is sometimes present. American hazelnut (*Corylus americana*) is a common shrub, and while the herblayer is similar to those found in oak forests and prairies, with many of the same grasses and forbs present, there are some plants and animals that reach their optimal abundance in the "openings".

Oak Woodland

This "forest" community is structurally intermediate between Oak Openings and Southern Dry Forest. The tree canopy cover is high, but frequent low-intensity fires and possibly (in pre-settlement times) browsing by herbivores such as elk, bison, and deer kept the understory relatively free of shrubs and saplings. Much additional information is needed but it appears that at least some plants (certain legumes, grasses, and composites among them) reached their highest abundance here.

Pine Barrens

This savanna community is characterized by scattered jack pines (*Pinus banksiana*), or less commonly red pines (P. resinosa), sometimes mixed with scrubby Hill's and bur oaks (*Quercus ellipsoidalis* and *Q. macrocarpa*), interspersed with openings in which shrubs such as hazelnuts, (*Corylus* spp.) and prairie willow (*Salix humilis*) and herbs dominate. The flora often contains species characteristic of "heaths" such as blueberries (*Vaccinium angustifolium* and *V. myrtilloides*), bearberry (*Arctostaphylos uva-ursi*), American hazelnut (*Corylus americana*), sweet fern (*Comptonia peregrina*), and sand cherry (*Prunus pensylvanica*). Also present are dry sand prairie species such as june grass (*Koeleria macrantha*), little bluestem (*Schizachyrium scoparium*), silky and sky-blue asters (*Aster sericeus* and *A. azureus*), lupine (*Lupinus perennis*), blazing-stars (*Liatris aspera* and *L. cylindracea*), and western sunflower (*Helianthus occidentalis*). Pines may be infrequent, even absent, in some stands in northern Wisconsin and elsewhere because of past logging, altered fire regimes, and an absence of seed source.

Shore Fen (formerly called Coastal Fen)

This open peatland community occurs primarily along Great Lakes shorelines, especially near the mouths of estuarine streams. Along Lake Superior most stands are separated from the lake waters by a sand spit. The floating sedge mat is composed mostly of woolly sedge (*Carex lasiocarpa*); co-dominants are sweet gale (*Myrica gale*) and bogbean (*Menyanthes trifoliata*). The following herbs are common in this diverse, circumneutral, nutrient-rich community: twigrush (*Cladium mariscoides*), marsh horsetail (*Equisetum fluviatile*), a spikerush (*Eleocharis elliptica*), intermediate bladderwort (*Utricularia intermedia*), marsh bellflower (*Campanula aparinoides*), narrow-leaved willow-herb (*Epilobium leptophyllum*), water-parsnip (*Sium suave*), and bog willow (*Salix pedicellaris*). Coastal fens are distinguished from open bogs and poor fens (which may adjoin them in the same wetland complex) by the lack of *Sphagnum* mosses, higher pH, and direct hydrologic connection to the Great Lakes. They are distinguished from rich fens by the absence of indicator species such as linear-leaved sundew (*Drosera linearis*), grass-of-parnassus (*Parnassia glauca*), false asphodel (*Tofiedia glutinosa*) and beaked spikerush (*Eleocharis rostellata*).

Southern Dry Forest

Oaks are the dominant species in this upland forest community of dry sites. White oak (*Quercus alba*) and black oak (*Quercus velutina*) are dominant, often with admixtures of red and bur oaks (*Q. rubra* and *Q. macrocarpa*) and black cherry (*Prunus serotina*). In the well developed shrub layer, brambles (*Rubus* spp.), gray dogwood (*Cornus racemosa*), and American hazelnut (*Corylus americana*) are common. Frequent herbaceous species are wild geranium (*Geranium maculatum*), false Solomon's-seal (*Smilacina racemosa*), hog-peanut (*Amphicarpaea bracteata*), and woodland sunflower (*Helianthus strumosus*).

Southern Dry-Mesic Forest

Red oak (*Quercus rubra*) is a common dominant tree of this upland forest community type. White oak (*Q. alba*), basswood (*Tilia americana*), sugar and red maples (*Acer saccharum* and *A. rubrum*), and white ash (*Fraxinus americana*) are also important. The herbaceous understory flora is diverse and includes many species listed under Southern Dry Forest plus jack-in-the-

pulpit (*Arisaema triphyllum*), enchanter's-nightshade (*Circaea lutetiana*), large-flowered bellwort (*Uvularia grandiflora*), interrupted fern (*Osmunda claytoniana*), lady fern (*Athyrium filix-femina*), tick-trefoils (*Desmodium glutinosum* and *D. nudiflorum*), and hog peanut (*Amphicarpaea bracteata*) . To the detriment of the oaks, mesophytic tree species are becoming increasingly important under current management practices and fire suppression policies.

Southern Hardwood Swamp (A split from Curtis' Southern Wet-Mesic Forest)

This is a deciduous forested wetland community type found in insular basins with seasonally high water tables. It is best developed in glaciated southeastern Wisconsin. The dominant trees are red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), and formerly, American elm (*Ulmus americana*). The exotic reed canary grass (*Phalaris arundinacea*) is often dominant in the understory. This Natural Heritage Inventory community partly includes the Southern Wet-Mesic Forest of the Curtis classification.

Southern Mesic Forest

This upland forest community occurs on rich, well-drained soils. The dominant tree species is sugar maple (*Acer saccharum*), but basswood (*Tilia americana*) and (near Lake Michigan) beech (*Fagus grandifolia*) may be co-dominant. Many other trees are found in these forests, including those of the walnut family (Juglandaceae). The understory is typically open (sometimes brushy with species of gooseberry (*Ribes*) if there is a past history of grazing) and supports fine spring ephemeral displays. Characteristic herbs are spring-beauty (*Claytonia virginica*), trout-lilies (*Erythronium* spp.), trilliums (*Trillium* spp.), violets (*Viola* spp.), bloodroot (*Sanguinaria canadensis*), blue cohosh (*Caulophyllum thalictroides*), mayapple (*Podophyllum peltatum*), and Virginia waterleaf (*Hydrophyllum virginianum*).

Southern Sedge Meadow

Widespread in southern Wisconsin, this open wetland community is most typically dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*). Common associates are water-horehound (*Lycopus uniflorus*), panicled aster (*Aster simplex*), blue flag (*Iris virginica*), Canada goldenrod (*Solidago canadensis*), spotted joe-pye-weed (*Eupatorium maculatum*), broad-leaved cat-tail (*Typha latifolia*), and swamp milkweed (*Asclepias incarnata*). Reed canary grass (*Phalaris arundinacea*) may be dominant in grazed and/or ditched stands. Ditched stands can succeed quickly to Shrub-Carr.

Submergent Aquatic

This herbaceous community of aquatic macrophytes occurs in lakes, ponds, and rivers. Submergent macrophytes often occur in deeper water than emergents, but there is considerable overlap. Dominants include various species of pondweeds (*Potamogeton* spp.) along with waterweed (*Elodea canadensis*), slender naiad (*Najas flexilis*), eel-grass (*Vallisneria americana*), and species of water-milfoil (*Myriophyllum*) and bladderworts (*Utricularia*).

Talus Forest (Description in preparation)